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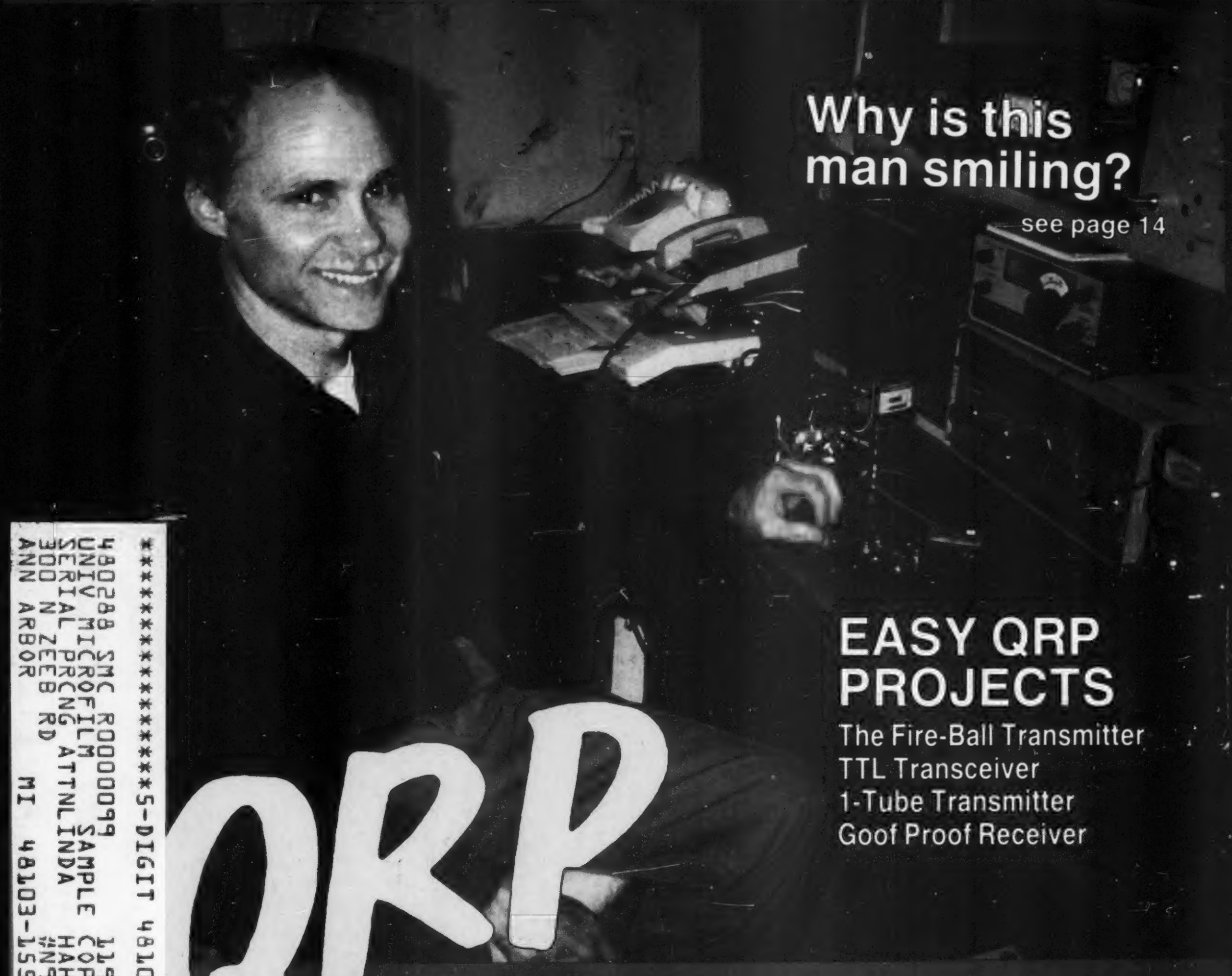
# 73 Amateur Radio Today



Why is this man smiling?

see page 14

## EASY QRP PROJECTS

The Fire-Ball Transmitter
TTL Transceiver
1-Tube Transmitter
Goof Proof Receiver

## 1990 Holiday Gift Guide

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You get a **new** lighted **peak** and average reading Cross-Needle SWR/Wattmeter with a **new** more accurate directional coupler.

**You** get a giant two core balun wound with teflon wire for balanced lines and a 6-position antenna switch with extra heavy switch contacts.

**Its** compact 10¾x4½x15 inch cabinet fits right into your station.

**You** get a 50 ohm 300 watt dummy load for tuning your exciter, a tilt stand for easy viewing and a 3-digit turns counter plus a spinner knob for exact inductance control. Add $10 s/h.

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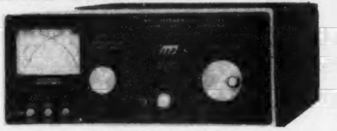

**MFJ-986**
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The **new** MFJ-986 Differential-T™ 2-knob Tuner uses a differential capacitor to make tuning foolproof and easier than ever. It ends constant re-tuning with broadband coverage and gives you minimum SWR at only **one** best setting. Covers 1.8-30 MHz.

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**It matches** dipoles, vees, verticals, mobile whips, random wires, banlanced and coax lines.

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**The** MFJ-949D gives you lower SWR than **any** tuner that uses two tapped inductors. Why? Because you get two **continuously** variable capacitors that give you infinitely more positions than the **limited** number on switched coils.

This gives you the precise control you need to get your SWR down to a minimum. After all, isn't that why you need a tuner? Covers 1.8-30 MHz.

**You** get MFJ's **new** lighted 2-color **peak** and average reading Cross-Needle SWR/Wattmeter, dummy load, antenna switch, and 4:1 balun - all in a compact 10x3x7 inch cabinet. Meter lamp uses 12 VDC or 110 VAC with MFJ-1312, $12.95.

With MFJ's **deluxe** 300 watt PEP tuner you get an MFJ tuner that has earned a reputation for being able to match just about anything - one that is highly perfected and has years of **proven** reliability.

## MFJ's *Mobile* Tuner

**MFJ-945C**
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Don't leave home without this **mobile** tuner! Have an uninterrupted trip as the MFJ-945C **extends your antenna bandwidth** and eliminates the need to stop, go out and adjust your mobile whip.

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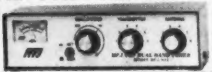
## *144/220 MHz VHF* Tuners

**MFJ-921** **$69.95**



**MFJ's new VHF tuners cover both 2 Meters and the 220 MHz bands.** They handle 300 watts PEP and match a wide range of impedances for coax fed antennas. SWR/Wattmeter. 8x2½x3 in. **MFJ-920, $49.95.** No meter. 4½x2½x3 inches.

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You get MFJ's **new** peak and average reading Cross-Needle SWR/Wattmeter with a **new** directional coupler for more accurate readings over a wider frequency range. It reads forward/reflected power in 200/50 and 2000/500 watt ranges. Meter lamp uses 12 VDC or 110 VAC with MFJ-1312, $12.95.

Has 6-position antenna switch and a teflon wound balun with ceramic feedthru insulators for balanced lines. 10¾x4½x14 7/8 inches. Add $10.00 s/h.

## MFJ's *smallest* Versa Tuner

**MFJ-901B**
**$59.95**

**The** MFJ-901B is our smallest -- 5x2x6 inches -- (and most affordable) 200 watt PEP tuner --when both space **and** your budget is limited. Good for matching solid state rigs to linears.

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# LETTERS

## From the Hamshack

**Ivy Renga W8IUQ, Milford MI** I have enjoyed your *73 Magazine* for over 18 years, and have watched it progress from FM to RTTY (computerized) to packet and now ATV on balloons. You have always dared to challenge the amateur radio community, and of course, the ARRL. This is good! Many of us tend to get stuck in a groove and need a little "kick in the pants" to realize our full potential.

**Ben Johnson NY0O** I'm a 37-year-old pharmacist and have been a ham for 22 years. In regard to your August editorial I'd like to see spread spectrum articles. And I might be interested in running for ARRL director. I joined the League in March 1987. Would I be eligible for the next election? How much time would it involve? I work for K-Mart and getting away for meetings might be a problem. Would I have to buy my own plane tickets to Newington? Is this strictly a job for an old man?

*Not this year, Ben. You must have at least four years of continuous membership to qualify. Yes, of course, they pay your travel expenses, and generously, too. Time? That's more a reflection of your interest. You should get around to as many clubs as you can and find out what your constituents are thinking. If I were going to be a director I'd get set up with a Mac and put out a monthly newsletter to help provide a communications medium between me and the clubs in my division. With this I could give them information on what is going on and generate interest in solving some of our more serious problems.*

*. . . Wayne*

**Mark Lovejoy KB0KJZ** I've been reading *73* for some time now and like it a lot. Your editorials are an inspiration and a stimulant when needed. Keep up the good work. In case anyone doubts your advice on getting publicity, I can say that the media is looking for stories about ham radio. I wrote an article about what hams do, different activities and modes, and the where/when of the club meetings. The paper thought it was great. The club info went on the front page that day and now they want to run more ham news. I'm hoping to get the club members to contribute material on RTTY, contests, QRP, and so on.

**John KB7DNF** You have a good magazine. I think you should publish the calls of lids, jammers, and the hams creating the mess on our bands. We need a clearing house for offenders.

**John Thurmond KB5HWS, Little Rock AR** I am 14 years old and I got my license one and a half years ago. Since then I've been trying to form ham clubs in the various schools I've attended. But this proposed Communicator license will take away my hope of recruiting new hams. Anyone can get a Novice license, but the Communicator will be much more difficult. Can you imagine me trying to explain to the average high school student what effect the F-layer has on radio propagation? The people who wanted a no-code license wanted one with HF privileges, not just UHF, so let's drop the whole thing.

*Why does ARRL's sneaky strategy to rekill no-code remind me of Oliver and Hardy? "Stan, a fine mess you've gotten us into this time!" . . . Wayne*

**D. Spreng WB0???** Re your June editorial comment on the huge postal rate hike and the "stupifying mail monopoly"—right on! I've been a postal worker for nearly four years, and I see the situation as hopeless. Thanks to your advice (get off your butt and out of your rut), I am changing. I am studying for my license with the help of the local club. I hope to help the local school set up a club. I have enrolled in a communications course and plan to get involved in electronics again. I quit electronics school in 1978—what a mistake! I would rather spend 50 years in a challenging career than work as a postal zombie for 25 and retire early. Keep it up, Wayne, you *are* getting people interested in ham radio and electronics! Your comments do not fall on deaf ears.

*Let me know your call, when you get it. Keep in touch! . . . Wayne*

**C. Hacksworth ET2/c USN** You couldn't be more right about the need for youngsters in amateur radio. Recently, while home after two years at sea, I went to a local ham club meeting with my grandfather. I was the only person under 30! Most were retired. When no-code was brought up, you'd think someone had cursed their mothers. These old-timers feel that no-code is a threat to them. What's so great about the code? Oh, tell W9KK that we Electronic Technicians (ETs) are not in any way, shape, or form, board swappers. We have to troubleshoot down to a component every day. How many pro-code fogies can handle that? This letter is a plea to take down the old barriers and let us young people in. My grandfather is actively trying to license youngsters. I wish more old-timers were like him.

**Dennis Murphy KB6LZW** While you seem pretty much well-informed and balanced in your opinion in your editorials, I feel you are mistaken about Techs. I don't believe that the majority of Techs are semi-hams in the process of stagnation. The majority are Techs because they are interested in the VHFs and UHFs and have no reason to upgrade.

*Thanks, Dennis, for enlightening me. Golly, I was afraid, after talking with a few hundred of them on repeaters, that there were 105,000 Techs, all so terrified of the code they're willing to miss talking to hams all around the world. But how come, if they're so into VHF, they don't write about all the experimenting they're doing up there?*

*. . . Wayne*

**Gib W7GTE** I find no argument with your diagnosis of the ARRL. Some of the crew there are well qualified, but many of them are NOT going to say anything contrary because that means goodbye job. Not too smart. Others at HQ. . .well. I was a vice-director for two years.

**John B. Bradley WJ0D, DA1JV** Keep up the good work, we all need prodding from time to time. You hit the nail on the head more than most would like to admit. Here is another one for your magic bag of "get it done" tricks!

I sent two letters to *CQ* and the ARRL to enlist their aid with whoever they have in the know to help reverse the abandoment of the Military Amateur Radio System.

This is not just hot air, since Paul Ramey, USAREUR MARS director told me this was happening, not only in the Army, but the Air Force as well. He had TWX copies of USAF messages stating that this was to happen in USAFE as well as describing what he was doing to phase down USAREUR's participation in Europe. There is not a replacement for him. Since the Army and Air Force are ending support for MARS, the rest is up to individuals.

MARS was a great help to me when I was away from the family, whether in the USN or USAF. MARS and local DA hams got California quake info to those stationed here in Europe; and probably for those in Asia as well, letting family members know that relatives in California were OK.

*Hmmm, MARS is being scuttled, eh? So what's the down side for amateur radio?*

*MARS has kinda kept to itself, with little effort at maintaining visibility. You either grow or you die.*

*I doubt that the military brass have any concept of the value of MARS. I know I don't, and I'm in the middle of things. . . . Wayne*

**Ken Stone WA2VWS, Cherryvale KS** In the June issue of *73* there was a very good article by Frank Brumbaugh on building a simple gaussmeter. I'd wanted such a meter for some time, and the article stimulated me to go ahead and build one. Mine is patterned after Frank's, but in my opinion much improved. Much of this was a result of Wayne Green asking his readers to do such a project. But there is a fly in the ointment.

Frank included a method for calibrating the gaussmeter. From correspondence with him, I learned he got the technical information from a consultant, and what he got and wrote up has a serious technical error. The article says the field intensity in gausses at the center of a long solenoid is NI/M (ampere turns per meter). This is incorrect by a factor of nearly 80. The correct equation is gausses = $0.004\pi NI/M$ (or $0.01257NI/M$). Still another form is ampere turns per meter divided by 79.58.

I have written to *73* three times already and the response has been exactly zero. For a technical magazine, this is unacceptable. To rub salt in the wound, the magazine published a trivial letter from a ham objecting to the use of cgs terms in the article instead of mks terms!! I have seen damning letters published before and I have seen corrections published. What is so holy about this error that I get nowhere trying to get a correction published?

*Thank you for your persistence! In this letter you have caught the fly in the ointment. The other letters were far too long and involved for "Letters" and we weren't sure which point you considered most important.*

*. . . de Linda KA1UKM*

**Bill Hollister, Jr., KA9ZHM, Big Rock IL** *A note to Gordon West WB6NOA, author of the "Service Survey" series, forwarded to 73:* [Regarding] your article on Alinco service: I had the opportunity to learn firsthand that Alinco's service and warranty are even better—yes, better—than the written word. We (Alinco and I) had a problem that spanned almost three years, but at no time were they anything but cooperative and polite. Too bad they make so few radios. How about 440 or HF?!

**W.M. Ashwood, Jr., WD5KBY/MM2** On many voyages between Corpus Christi, Puerto Rico, and Bayonne, I've heard no less than 50 bootleg stations on 10m. They were all fishing boats engaged in the shrimp industry and boat captains talking to their XYLs.

As they seem to prefer AM and FM, and shrimpers are notoriously long-winded, they should prove to be an interesting foxhunt for coastal clubs.

However, I don't recommend personal confrontation. With detailed information, the FCC can deal swiftly with the situation.

**Chris Kochenour WD1W, Pownal VT** Here is an idea, offered as a challenge to every licensed ham, that will swell our ranks for now and forever.

Here is the challenge: Every year, each and every ham take one person under his/her wing, and teach/guide them to the point of being licensed. Imagine 500,000 hams in 1990; 1,000,000 hams in 1991; 2,000,000 in 1992. . .8,000,000 in 1994.

What are you waiting for? Get off your duff and take the challenge. Enlist someone now. . .Oh—too many kids and overcrowded bands? Well, your only hope is that you die before amateur radio does.

**Page Pyne WA3EOP, Williamsport MD** Wayne's recent editorial on the future of our hobby should give everyone something to think about.

I read recently in the *Philatelic Press* about COPO, a nonprofit organization composed of more than 450 stamp clubs, dealers, and other groups and individuals, for the purpose of promoting stamp collecting. COPO offers The Lidman Prize for the best article about stamps or stamp collecting appearing in the nonphilatelic press. The Council of Philatelic Organizations awards the winner $500, an engraved plaque, and an expense paid trip to the award site.

With the need for good public relations, amateur radio should have its own version of a Lidman Prize saluting the best writings about amateur radio in the nonamateur press. Perhaps we could have several categories annually, for newspapers, periodicals, videos, etc. Do you think we could find a national organization to grab the ball and run with it for the good of amateur radio?

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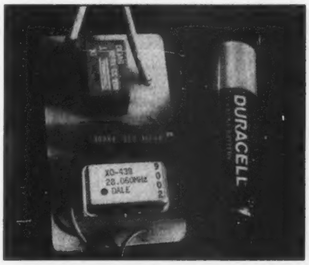

*Build the FIRE-BALL . . . see p. 18.*

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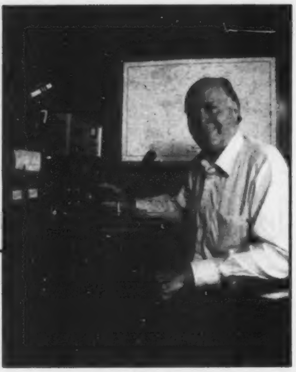
# NEVER SAY DIE

Wayne Green W2NSD/1



## On Being Reasonable

On my letterhead I have a quote from George Bernard Shaw: "The reasonable man adapts himself to the world, the unreasonable one persists in trying to adapt the world to himself. Therefore, all progress depends on the unreasonable man."

Are you a reasonable man? Most men are. They peacefully go along with the laws and customs, whether they agree with them or not. They try not to make waves. I've always been unreasonable. Worse, I've always tried to encourage other men to be unreasonable.

Our New Hampshire constitution is clear on this matter. It says that if a man believes a law is unreasonable, it is his responsibility to oppose that law.

There are some aspects of our society that I feel are unreasonable for me to accept. Like our present educational system. Like our consumer electronics industry loss. Like the erosion of amateur radio . . . in both quality and quantity.

I get hundreds of letters from readers who say they're fed up with amateur radio. Some are discouraged by the lack of interesting contacts. Some by jamming, bad language or ham club elitism. The reasonable man, faced with such obviously insurmountable obstacles, gives up. The unreasonable man says, "Hey, what am I going to do about this mess?"

Is it your destiny to be a sheep . . . or a shepherd? Are you a reasonable man who accepts what others deal out, no matter how unpleasant? What kind of legacy will you leave? Will the world miss you much when you pass on?

We've had a few hams who've done a great deal to make hamming more fun for the rest of us. I've been privileged to know a number of these outstandingly unreasonable men. There was John Williams W2BFD, who did more than any other ham to popularize RTTY. There was Bill Hoisington K1CLL, whose simple construction articles in *73* got a generation of readers into building. There was Gus Browning W4BPD, whose DXpeditions made hamming more fun for thousands of us.

You don't have to write on a big slate to contribute. Look at Bill Welch W6DDB, who's helped thousands of Novices get licensed! And Gordon West WB6NOA, whose Radio School has also helped thousands get licensed. How about Bill Pasternak WA6ITF and his *Westlink Report*? We've had lots of hams who have helped our hobby. Then we've a couple hundred thousand reasonable men who have left no mark to show they were ever with us except one line in the *Callbook* . . . and then, eventually, that final line in Silent Keys.

Reasonable men do not win contests, go on DXpeditions, write construction articles, set up repeaters, get deeply involved with emergency operations, have interesting QSL cards, have the time or interest to elmer new hams, are an excruciating bore to contact, tend to absolutely hate my editorials, have never experimented on any microwave bands, have never even considered OSCAR or moonbounce, have never made RTTY, packet, SSTV or ATV contacts, never made DXCC, never made BPL (may not even know what it is), never been a ham club president or organized a hamfest, never flown a plane or been up in a balloon, probably never skied or dived, and so on. The reasonable man not only doesn't contribute to progress, he generally resists it, but not vigorously . . . as that would call for an actual commitment.

The American educational system is a mess. You know that. You've probably been grumbling about it. Have you done anything? Have you read much about it to find out what's gone wrong? Have you been taping the excellent TV documentaries on the subject? Now, more important, once you understand the problems and some proven solutions, are you volunteering for your local school board to help make some changes?

You may believe that ham clubs in your local schools would help youngsters develop an interest in science and high-tech careers, but unless you actually do something about it, you are a cypher. And being on the school board sure won't hurt.

Is your local ham club generating Novices? Is it putting on fox hunts? Organizing a big Field Day outing? Getting together for VHF contests? Has it a repeater? Are the meetings interesting enough so the club is growing? When you get your Silent Key listing, what will you have left behind besides a few minutes of empty band space where you used to ragchew?

Sure, I'm unreasonable. And I've done just about everything I listed above. But, you know, I haven't done anything you couldn't have. It's not that I'm a superman, I'm just plain unreasonable. When something stinks I don't hold my nose and turn away . . . I get out the mop and see what I can do to clean up the mess.

> *"We've had a few hams who've done a great deal to make hamming more fun for the rest of us."*

When someone has a rotten signal I do my best to politely let 'em know. When someone is lousing up the band with bad language or jamming, I speak up, doing my best to keep my cool . . . which isn't easy at times. And when I come across outstanding problems such as KV4FZ and K1MAN present, I write, hoping you'll take some initiative.

The reasonable man would never consider running for ARRL director. The reasonable man has adapted to the way things are, either by putting up with them or turning away and ignoring 'em.

If you read, perhaps you've read *Hit Men*, the story of how The Mob has taken over control of the music business. If I can find some unreasonable people to help me, I've got a sneaky plan to elbow The Mob back out again. I'm already about 10% along with this guerrilla action, so I'm doing something.

How about helping to keep our country in better touch with the latest in high tech developments, most of which are happening in Japan . . . and which, oddly enough, the Japanese resist sharing? I came up with a beaut of a solution to this one . . . and planted the seed in exactly the right place for optimum growth. I know that reasonable readers are tired of me blowing my horn about all the things I've done. But I find that unless I can prove that it's actually possible for someone to do things, reasonable men convince themselves that it's beyond them.

When I explain how easy it is to make money I get jealousy and hate from reasonable men . . . and hey, how can I get a piece of the action, from unreasonable men. When I suggest that all it will take is a few unreasonable hams to run for ARRL directors and bring the League into the '90s, I get a mixture of apathy and hate. The reasonable man says I'm trying to change things and that's bad. The unreasonable man says, "Hmmm, who do I know who would make a good director and help get us out of the mess we're in?"

So yes, while reasonable men were rag-chewing on 75m, I was out there on an icy New Hampshire mountain top, making contacts with seven states on 10 GHz. And while the reasonable hams were fighting pileups to get through to me, I was operating from JY, 5Z4, 5W4, 7P8, 3W6, FP8, FO8, FK8, 9N, 9M6, 9M8, etc. And Gus was operating from Western Africa. And Lloyd and Iris Colvin from everywhere else in the world.

What were reasonable hams doing when I was building RTTY, NBFM, and SSB equipment . . . and experimenting with SSTV, moonbounce, aurora, 10 GHz? What were they doing while I was winning Sweepstakes, DX and VHF contests? Sure, I've worked about 350 countries and rag-chewed with tens of thousands of reasonable hams. But is the reasonable man irritated with me blowing my horn about all that, or because he's had the same opportunities I had and he has never done anything?

I'm writing this because the world needs more unreasonable men. Can reasonable men be blasted out of the herd with logic? It's not safe being unreasonable, so perhaps not. You have to think. You have to read and learn. You have to take chances! And you have to face the multitudes of reasonable men who will resist you every inch of the way.

## WARC-'92

I got a letter from the League listing a whole bunch of ways amateur radio looks like it could get badly hurt at the coming WARC. This was accompanied with a request for a donation. You can imagine what a tough time I had not reaching for my check book!

Of course, having participated as an official WARC delegate in Geneva, I knew that by conference time the delegates from the other countries would have their positions cast in concrete, giving them very little room to maneuver. The time for WARC work is right now, not two years from now, after it's

*Continued on page 73*

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### HF transceiver with general coverage receiver.

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Optional Accessories:

- **AT-130** compact antenna tuner
- **AT-250** automatic antenna tuner
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- **IF-232C/IF-10C** computer interface
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- **MB-430** mobile bracket
- **MC-43S** extra UP/DOWN hand mic.
- **MC-55** (8-pin) goose neck mobile mic.
- **MC-60A/MC-80/MC-85** disk mics.
- **PG-2S** extra DC cable
- **PS-430** power supply
- **SP-41/SP-50B** mobile speakers
- **SP-430** external speaker
- **SW-2100** SWR/power meter
- **TL-922A** 2 kW PEP linear amplifier (not for CW QSK)
- **TU-8** CTCSS tone unit
- **YG-455C-1** 500 Hz deluxe CW filter,
- **YK-455C-1** New 500 Hz CW filter

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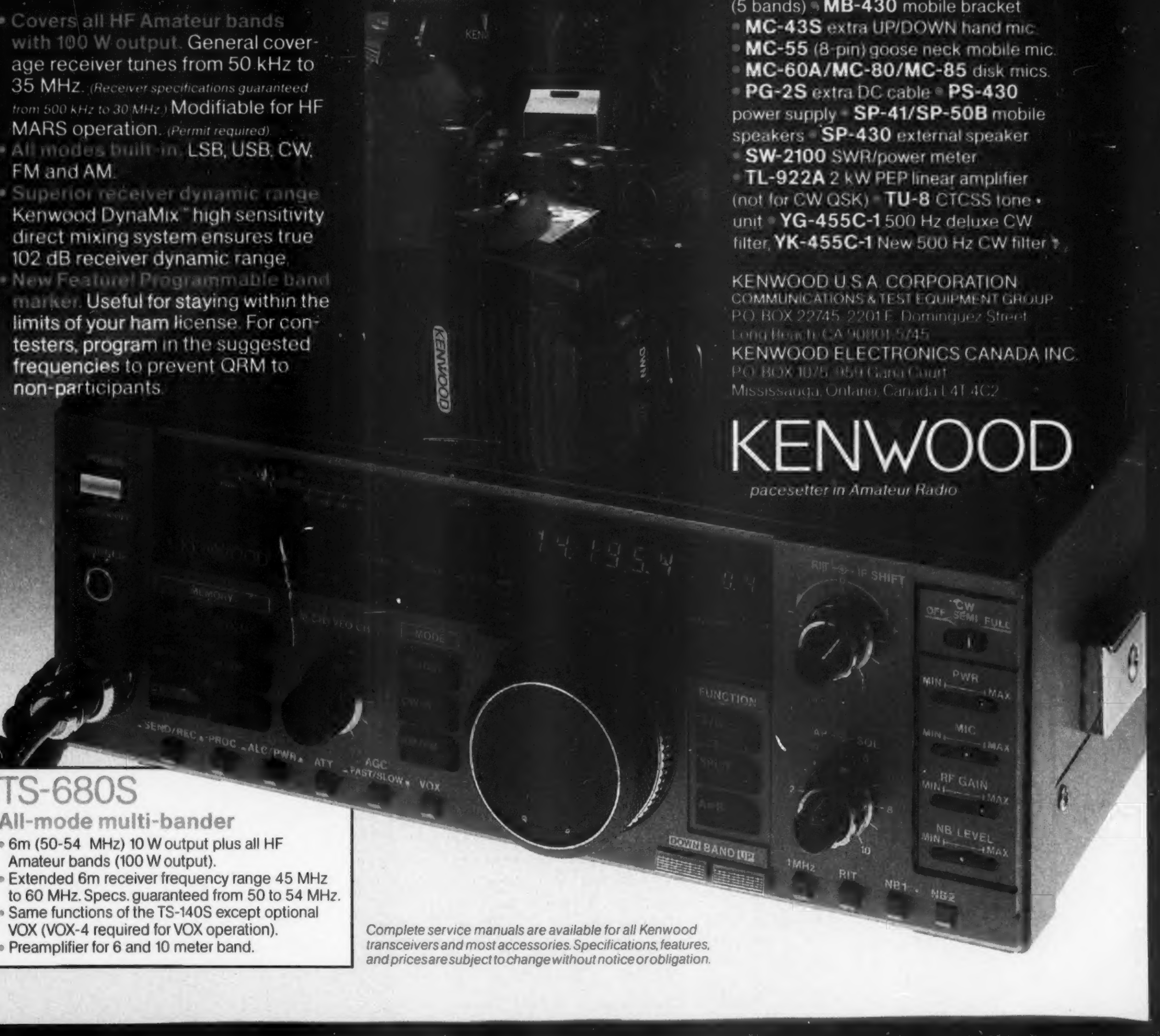

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*Complete service manuals are available for all Kenwood transceivers and most accessories. Specifications, features, and prices are subject to change without notice or obligation.*

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- **High power output.** 50 W on 144 MHz, 35 W on 450 MHz, and 10 W on 1200 MHz. (Selectable low power: 5 and 10 W, 1 W on 1200 MHz.)
- **Wide band receiver coverage.** 118-174, 438-450 (400-475 after modification), 1240-1300 (1210-1330 after modification) MHz. TX on Amateur bands only. Modifiable for MARS/CAP. Permits required.
- **CTCSS encode/decode built-in.** 38 sub-tones selectable from the front panel.
- **Cross-band repeat function.** Selectable single or dual input! Off-set function on output, allows simplex to repeater repeat!
- **Simultaneous tri-band receive.** Individual volume and squelch controls help you "sort out" the signals.
- **Detachable front panel.** Use the optional PG-4K or PG-4L to mount the front panel remotely.
- **Selective calling option (DTU-2).** Selectively call a single station, or call a group with DTMF tones.
- **303 memory channels.** Store everything you need for efficient operation. All channels allow you to store "odd split" repeaters.
- **Versatile scanning functions.** Band scan, memory scan and programmed scan with carrier or time operated stop.
- **NEW! Auto memory scan.** Automatically memorizes a busy frequency while scanning the band!
- **Automatic repeater offset on 2 m.** Plus or minus 600 kHz for 144 MHz, ±5 MHz on 450 MHz, and ±12 or 20 MHz for 1200 MHz. (Manual offset for 450 and 1200 MHz.)
- **Fixed detect output.** For packet operators!
- **Multi-function DTMF mic supplied.**
- **Auto power off and time-out timer.**
- **4-step dimmer control.** Selectable 4-step dimmer control.
- **Three separate antenna and speaker connectors.** For maximum performance.

**Optional Accessories:**

- **DTU-2** Digital paging (DTMF) unit
- **PG-4K, PG-4L** Front panel cable kits
- **MC-45** Multi function mic.
- **MB-11** Extra mounting bracket
- **SP-41, SP-50B** External mobile speakers
- **PG-3B** DC line noise filter
- **PS-430** Power supply
- **PG-2N** DC power cable.

***Complete service manuals are available for all Kenwood transceivers and most accessories.***

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# QRX . . .

EDITED BY LINDA RENEAU KA1UKM

## BARF Members Cited

**Several BARF members have been cited for violating Section 97.101(d) of the FCC rules**—causing willful and malicious interference to the communications of amateurs. The names of all members receiving "Notices of Violations" and "Notices of Apparent Liability" from the FCC are unknown at present. Herbert L. Schoenbohm KV4FZ is the person most amateurs name as the cause of the mounting 20 meter controversy.

Two decades ago Schoenbohm was a hero among radio amateurs for his public stand against abuses by wealthy yachtsmen who openly used the 15, 20, and 40 meter bands for business phone patching. Due to his efforts, within a year virtually all the violators were off the air.

Unfortunately, he later expanded his campaign, forming the Better Amateur Radio Federation (BARF) as a net to counter the activities of nearly all established service nets and international phone patching.

Other BARF members who have been fined include Richard K. Eastman N5FX and William Terrill K2BFI ($1,000 each). Cited, but not fined, were Harold D. Case WD4PZT and William Pike N0DCP. Last September, the FCC began preparing an in-depth "Public Notice" on the matter. From the *Westlink Report*, Number 584.

## Hams in Action

**Last August, Tomah, Wisconsin, was hit by severe thunderstorms and flooded by more than eight inches of rain in less than three hours.** The coordinator of the Monroe County Emergency Government in Tomah contacted Mark Loether KB9EBX to request the assistance of the Tomah Regional Repeater Group. The Monroe County ARES went promptly into action, helping with evacuation and establishing radio communication.

As more people were evacuated from their homes on the morning of the 18th, Richard Koebernick KA9ZZK and Jason Sweeney N9GNA established intitial communications between the Tomah Red Cross at evacuation centers and the LaCrosse Red Cross office. Later, Mike Warnock WN9P arrived from Sparta to relieve them when their own homes became endangered.

Bill Bastain N9BOE manned the local Tomah Weather Radar as more rain threatened the community. Dave Arnold N0CUO from Necedah arrived that afternoon to provide additional support and relief, and that evening Clide Downing N9KAK from the Wisconsin Rapids/Wood County Amateur Radio Service came with fourteen more amateur radio operators.

On Sunday, local operators Allen Bell KA9PSL and Ken Teclaw N9GXP stayed on duty and maintained communications between the emergency government and the Red Cross. From the *Tomah Regional Repeater Group.*

## Calling the USSR

**Net Manager Glen Baxter K1MAN** of the International Amateur Radio Network acknowledged on the air August 22 that he received a Notice of Rules Violation from the FCC for running a phone patch to the Soviet Union, a nation with whom the United States has no third party agreement. According to Baxter, his organization was trying to promote international good will by helping a Soviet exchange student make contact with home, and the operator in the USSR thought it was legal on his end.

Baxter says that he notified the FCC monitoring station that until a third party agreement is in force between the two countries, he will refrain from such activity. The FCC station apparently accepted his explanation; Baxter says he received a FAX from them and it appears that the matter is closed. The FCC in Washington, however, has the right to review the decision and the option to take punitive action. From the *Westlink Report*, Number 584.

## SAREX Packet Hints

**Be sure to use the right callsign** when you try to connect to SAREX. Tom Clark W3IWI reports that both the HK21 ROBOT TNC and the software for the GRID laptop computer have the calls defaulted to WA4SIR (SSID=0), not WA4SIR-1. The call WA4SIR, belonging to astronomer Ron Parise, should be used unless for some unanticipated reason, the defaults are overridden. Tom says the best advice is for you to monitor the downlink signals from STS-35 and use the call you see on the downlink. The ROBOT TNC code uses only one SSID at a time.

The SAREX handheld cannot receive when it's transmitting. Do not run full duplex on the ground! Leave your TNC in half-duplex mode with CD active, just as you would for normal VHF packet operations.

Be careful with your TNC's timers, DWAIT (How soon do I transmit?) and FRACK (Then how long do I wait?). Try to pick a DWAIT nobody else is using, and set FRACK for at least three seconds so that you won't transmit when the ROBOT's FUDtimer (listening before transmitting) decides it's time to transmit. From *W3IWI via AMSAT News Service,* and *Westlink Report.*

## Operation "Desert Shield"

**Do you want to listen in on the Middle East?**

Try these times and frequencies (kHz):

| | | |
|---|---|---|
| 0200–0300Z | Radio Cairo | 9475, 9675 |
| 0300–0350Z | Radio Baghdad | 11830 |
| 0300–0400Z | Voice of Turkey, Ankara | 9445, 17880 |
| 0300–0400Z | United Arab Emirates | 13675, 15400, 15435 |
| 0300–0415Z | Kol Israel | 9435, 11605, 12077, 15640 |
| 2000–2200Z | Radio Baghdad | 13660 |

"Tokyo Rose" broadcast to our troops are on 11860 at 1000–1200Z, 1600–1800Z, and 2000–2200Z, but propagation may not be good. (DX packetcluster message by K5KJ and W5USM; courtesy AD5I.)

U.S. Airbase in Insulic, Turkey: 6.738, 11.176, 13.214 (courtesy AJ9S).

British Forces Broadcasting Service to Saudi Arabia: 7125, 9640, 13745, 15205, 17695, 21735 (courtesy K5KQG).

From *The Parking Ticket*, #2322.

## Microwave Conference

**On January 30, 1991, the Colorado Front Range Microwave Society** is sponsoring the Microwave Update Conference at Denver. By providing an informal forum for exchanging ideas, designs, and operational experience at frequencies above 900 MHz, the conference intends to serve the needs of the amateur microwave community.

All radio amateurs are invited to submit talks and papers. Presentations may range from 15 to 45 minutes long. They should stress practical applications on all aspects of microwave operation.

A collection of presentations will be published. Final versions of the material should be ready by November 15, 1990. If interested, contact Don Lund WA0IQN at P.O. Box 1664, Boulder CO 80306. *[We regret that we were unable to put this notice in the October issue, but some of you will surely be interested in attending the conference, and others may have a finished manuscript on hand ready for submission.]*

## TNX. . .

**. . . to all our contributors.** You can reach us by phone at (603) 525-4201 or by mail at *73 Magazine,* Forest Rd., Hancock NH 03449; and by e-mail on CompuServe ppn 70310,775, MCI Mail "WGEPUB" and the *73* BBS at (603) 525-4438 (300–2400 bps), 8 data bits, no parity, one stop bit.

Number 4 on your Feedback card

73 Review

by David Cassidy N1GPH

# MAX System Ground Plane Antennas

## *A quality, low-cost alternative to the ol' "coat hanger special."*

Cellular Security Group
4 Gerring Road
Gloucester MA 01930
(508) 281-8892
Price Class: $30

---

Is there a Technician class or higher amateur who has not built a 2 meter quarter-wave ground-plane antenna? If you haven't built one, here's the formula: First, cut a couple of wire coat hangers into five pieces, each 19 inches long. Scrape the coating down to the bare metal, then solder one piece to the center of an SO-239 for the radiating element. Solder the remaining four pieces to the corners of the SO-239 at a 45 degree angle. Trim for lowest SWR and you're all set! I've been using this exact version, held to the roof with four roofing tacks, for local repeaters and 2 meter packet.

### The MAX System

A company called Cellular Security Group has taken this antenna (which they admit comes directly from *The ARRL Handbook*) and named it the "MAX System." These antennas are available as the MAX 146 for 2 meters, the Max 220 for 220 MHz, and the diminutive MAX 440 for 440 MHz. For only $29.95, including free shipping and a money-back guarantee, this may be the year's best bargain in ham radio!

The antenna comes fully assembled, all in one piece. It looks like any other quarter-wave ground-plane except for one important difference: the quality of construction is outstanding. The elements are stainless steel, the soldering is first rate, and it's all protected from the weather by a PVC endcap. A six-inch extension tube comes standard, and a 38-inch tube is available for $5. You can also order your antenna with an N-connector (recommended for 440). Run some coax up the tube, connect, fit the antenna onto the tube and mount it any way you like: on the side of a tower, at the peak of your roof, hanging off of a convenient pine tree, etc. I've got the thirty-eight inch extension taped securely to a 10-foot Fiberglas™ pole, which is in turn pushed into the ground. A semi-permanent installation at best (with the extra three feet the antenna is about 12 feet above ground level), but it works great and that's what counts.

How well does the MAX 146 work? It's not going to give you the gain of a beam, and refreshingly, the company doesn't claim any extraordinary and unbelievable performance. The SWR is below 1.4:1 across the entire 2 meter band.

In a direct comparison test between my homemade "Coat Hanger Special" and the MAX 146, the Max 146 wins hands down. Even though my home-brew quarter-wave is on top of the roof (35–40 feet) and the Max 146 is only 12 feet above the ground, the Max 146 gets me connected to packet nodes that my home-brew antenna can't. A repeater about 40 miles away gives an S7 reading on my home-brew antenna. When the same radio is connected to the Max 146, I get a full meter reading. This simple comparison may say more about my construction abilities than I'd like to admit, but the point is made. The Max 146 is a quality antenna that does exactly what it is supposed to do: give the best performance possible in a low-cost antenna.

The Max 440 has the same quality construction, plus the added benefit of its small size. You can attach it directly to your HT! It would take some contortions to make it comfortable to wear on your belt, but the performance benefit over a rubber duckie makes it worth the inconvenience of carrying your radio. You could always run some coax from your HT and mount the Max 440 on your hat. That should get you noticed at the next hamfest!

The only problem I have with the Max System antennas is more of a suggestion than a "problem." When first looking at the antennas, my initial thought was that they would make great camping/backpacking antennas. Then I realized that the elements are permanently soldered to the connector. I think that Cellular Securities Group would have a whole new market for these little beauties if they somehow made the ground-plane elements removable. Perhaps a banana jack/plug arrangement would work. They could even offer a separate portable model. If the quality were the same as the current models, I know they'd have a winner.

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*David Cassidy N1GPH is the associate publisher of* 73 Amateur Radio Today. *Contact him %* 73.

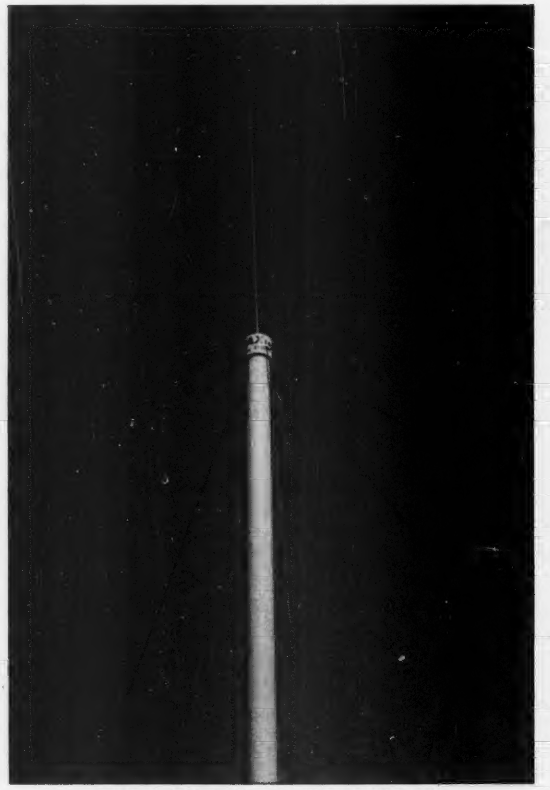

*Photo A. Cellular Security Group's MAX-146.*

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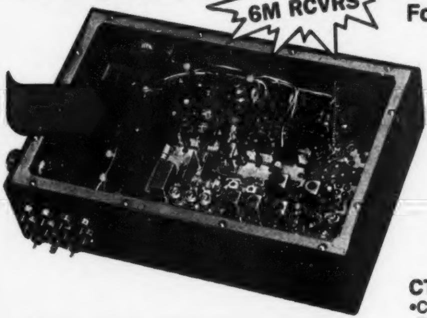

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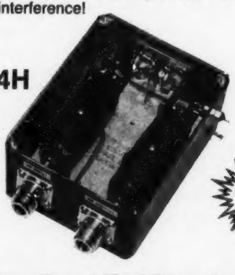
**FL-4H**



NEW

### Receiver Front-End Preselectors

- **FL-6: 6Hi Q Resonators with Lo-Noise Transistor Amp (2M or 220 MHz)**
- **FL-4H: 4Hi Q Helical Resonators & Lo-Noise Tr. Amp. in shielded housing. (420-470 MHz)**
- **Provides tremendous rejection of "out-of-band" signals w/out the usual loss!** Can often be used instead of large expensive cavity filters.
- Extremely helpful at sites with many nearby transmitters to "filter-out" these out-of-band signals.

## Call or Write for Data Sheets

### ID250A CW ID & Audio Mixer Board

- **Improved! Now includes "audio mute" circuit and "Emergency Power ID" option.**
- 4 input AF Mixer & Local Mic. amp.
- PROM Memory—250 bits/channel.
- Up to 4 different ID channels!
- Many other features. Factory programmed.

### CTC100 Rptr. COR Timer/Control Bd.

- Complete solid state control for rptr. COR, "Hang" Timer, "Time-Out" Timer, TX local & remote Shutdown/Reset, etc.
- Includes inputs & outputs for panel controls & lamps.

---

### Power Supply Boards

NEW

- **SCP12** 12 VDC @ 0.3A MAX. OUT.
- **SCP512** 12 VDC @ 1A & 5VDC @ 0.4A out. (1.1A total max. out.)

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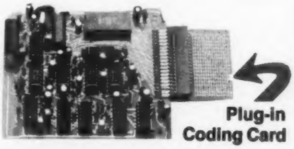
NEW



**Plug-in Coding Card**

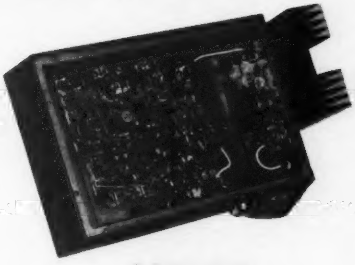
### TTC300 TOUCH TONE CONTROLLER

- High performance, Super versatile design. To control any ON/OFF Function at a remote site via DTMF Radio Link.
- Uses new high quality Xtal Controlled Decoder IC, w/high immunity to falsing
- Decodes all 16 digits
- 3 ON/OFF Functions per Main Card. Easily expandable to any no. of functions w/Expansion Cards.
- Codes quickly field programmable via plug-in Coding Cards. Many unique 3-digit codes available. Not basically 1-digit as with competitive units.
- Latched or pulsed outputs.
- Transistor Switch outputs can directly trigger solid state circuitry or relays, etc. for any type of control function.
- Low Power Consumption CMOS Technology. 5VDC Input. Gold-plated connectors.

NEW

### SCP30 HEAVY DUTY 30 AMP RACK MT. POWER SUPPLY

- 13.8 VDC out. 115/230 in, 50/60 Hz.
- 30A @ 70% duty, 25A @ 100% duty.
- Massive 30 lb. Transformer & Heat Sinks.



### SCT410B Transmitter Assy.

### SCT110 VHF Xmtr/Exciter Board

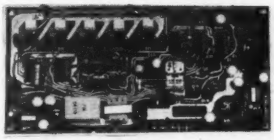
- **10 Wts. Output. 100% Duty Cycle!**
- Withstands High VSWR
- True FM for exc. audio quality
- Designed specificially for continuous rptr. service. Very low in "white noise."
- Spurious – 75 dB. Harmonics – 60 dB.
- With .0005% precision grade xtal.
- **BA-30 30 Wt. Amp board & Heat sink,** 3 sec. L.P. filter & rel. pwr. sensor.
- **BA75 75 Wt. unit also available**

### SCT110 Transmitter Assembly

- ***SCT110 mounted in shielded housing***
- Same as used on SCR 1000 & 2000X
- Completely assmbld. w/F.T. caps, SO239 conn.
- 10, 30, or 75 Wt. unit.

### SCT 410B UHF Transmitter Bd. or Assy.

- Similar to SCT110, 10 Wts. nom.
- ***Includes "on board" proportional Xtal Osc./Oven circuitry for very high stability!***
- **BA-40 40W. UHF AMP. BD. & HEAT SINK**



### SCAP Autopatch Board

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- 0/1 inhibit bd. also available
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- Used w/SCAP board to provide "Reverse Patch" and Land-Line Control of Repeater
- Includes land-line "answering" circuitry

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- Gas Discharge Tube shunts phone line surges to ground
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CIRCLE 51 ON READER SERVICE CARD

# AEA ...Brings You A

## Keyers

### The Morse Machine MM-3 Keyer

The Morse Machine has all the features you need in a memory keyer, including 2 to 99 WPM speed selection and over 8,000 characters of soft-partitioned memory. Twenty memories store your messages...as short or as long as you like. Memory can be expanded to 36,000 characters. All memory is backed up by an internal lithium battery.

Comprehensive Morse training facilities are built-in. **A Proficiency Trainer** for random code group practice. **A Random Word Generator** which generates four-letter words and **A QSO Simulator** which allows you to call stations, answer a CQ or listen to realistic on-the-air QSO's.

The MM-3 also features automatic serial number insertion and incrementing in any memory message. Use the front panel knob to adjust your sending speed or enter a precise speed with the keypad, toggling between the two at any time. Exchanges can be expedited by having parts of your message sent at a higher speed. You can even add remote switches for four of the memories to send your response or call CQ. The MM-3 can also be programmed for automatic beacon use. The RS-232 compatible serial I/O port provides computer control of the MM-3 and monitoring of the Morse training features.

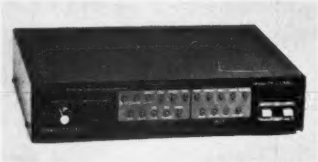
## Packet

### PK-88 Packet Radio TNC

Unique operating features with a proven hardware and software design make AEA's PK-88 your best choice in packet radio--now with MailDrop, an 8KByte efficient personal Mailbox. The PK-88 also allows multiple single frequency QSO's, digipeating and networking. It's a superb value, packed with all the most needed packet radio features such as direct interface capability with NET/ROM and TCP/IP. In addition to all the features of a "standard" TNC, the PK-88 offers features not found in any other TNC:

- WHYNOT command - Shows reasons why some received packets are not displayed.
- "Packet Dump Suppression" - Prevents dumping unsent packets on the radio channel when the link fails.
- CUSTOM Command - Allows limited PK-88 customization for non-standard applications.
- Enhanced MBX command- Permits display of the data in I- and UI-frames, without packet headers and without packet headers or retried frames.
- Enhanced MPROTO command - Suppresses display of non- ASCII packets from Level Three switches and network nodes.

## Multi-Mode



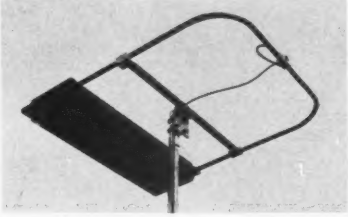
### PK-232MBX Multi-Mode Data Controller

With over 40,000 units sold worldwide, the PK-232MBX is the world's leading multi-mode data controller. Combining all amateur data communication modes in one comprehensive unit, the PK-232MBX offers Morse Code, Baudot, ASCII, AMTOR/SITOR 476 and 625, HF and VHF Packet, WEFAX receive and transmit, TDM, as well as commercial standard NAVTEX automated marine information services.

All software is on ROM.

- 20 front panel status and mode LED indicators
- RS-232 compatible
- Exclusive SIAM™ Signal Identification and Acquisition Mode
- TDM Time Division Multiplex decoding
- PakMail™ mailbox with selective control of third-party traffic
- FAX printing - supports most printers
- Two radio ports
- Host mode for efficient program control of the PK-232MBX
- KISS mode for TCP/IP networking protocol compatibility
- 32K RAM lithium battery-backed
- Many features for the digital SWL

## Antennas



### IsoLoop™ 14-30 MHz Compact HF Antenna

AEA brings you the breakthrough in compact HF antenna design with its high-performance, low-profile IsoLoop HF antenna. Designed specifically for hams with limited space or antenna restrictions, the 32"-square IsoLoop covers all frequencies from 14 to 30 MHz, at up to 150 watts continuous.

No ground radials are needed and its balanced, shielded feed-loop isolates the antenna from the feedline. This ensures that your signal is radiated by the antenna, not the feedline, which helps eliminate TVI and stray RF in the shack.

The inherent hi-Q of the IsoLoop makes it like a very sharp tunable filter that radiates. The narrow bandwidth suppresses harmonics from your transmitter, and also attenuates out-of-band signals that could overload your receiver.

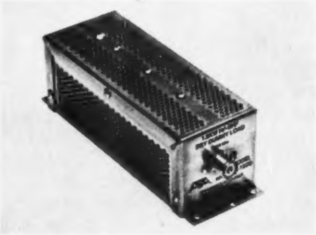
The omni-directional IsoLoop makes an excellent attic or balcony antenna, and because it weighs only 12 pounds is also perfect for portable use.

Advanced Electronic Applications, Inc. 2006-196th St. SW/P.O. Box 2160 Lynnwood, WA 98036 206-775-7373

**CIRCLE 65 ON READER SERVICE CARD**

# Better Experience

## Dummy Load

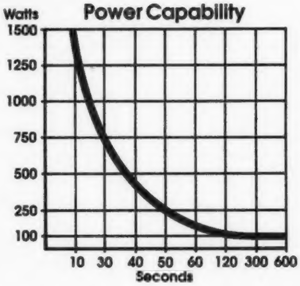


### DL-1500

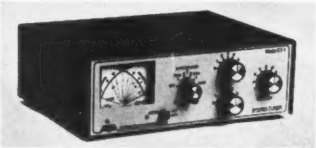
**DC-650 MHz Up to 1500 Watts**

AEA's dry dummy load simulates a perfect 50 ohm antenna up to 650 MHz so you can test your transmitter without radiating a signal on the air.

- DC-650 MHz
- Simulates matched 50 ohm transmission line to test your transmitter
- Handles short-term RF power up to 1500 watts
- VSWR of less than 1.3:1 at 650 MHz
- Compact and lightweight
- Air cooled dry load


Power Capability

## EconoTuner



### ET-1 Antenna Tuner

**300 Watts of All-Band Tuning**

Meet your match with AEA's new ET-1 Econo-Tuner™. A quality, economical antenna tuner for under $150, the ET-1 Econo-Tuner is designed to match virtually any receiver, transmitter or transceiver from 1.8 to 30 MHz with up to 300 watts of RF power.

Compatible with almost ANY antenna including verticals, dipoles, inverted vees, beams and mobile whips that are fed by coax cable, balanced lines or a single wire. For easy connection to balanced lines, a 4:1 balun is built-in.

A front panel switch control allows you to switch between two coax-fed antennas (direct or through the tuner). You can also switch to a balanced line or wire antenna. The BYPASS position allows you to switch to a dummy load (such as AEA's DL-1500 dry dummy load) or a direct connected coax antenna. In the BYPASS position, COAX 1 OUT or COAX 2 OUT can be selected so that the tuner is bypassed, but not the meter circuit.

The ET-1 features a precision dual-movement meter to simultaneously monitor power and SWR.

Unique engineering designs have made AEA one of the leading innovators in the amateur radio industry. That same quality and superior technical support make the ET-1 your best deal for an antenna tuner.

## Antennas

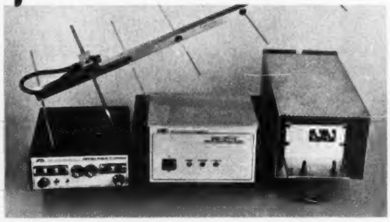
**IsoPole™ Omni-Directional VHF and UHF Base Station Antennas**

An outstanding mechanical and electrical design make the IsoPole the best choice for an economical omni-directional VHF or UHF base station antenna. All IsoPole antennas yield the maximum gain attainable for their respective lengths and a zero degree angle of radiation which puts the most signal on the horizon. Exceptional decoupling results in simple tuning and a significant reduction in TVI potential. Decoupling cones offer great efficiency over obsolete radials which radiate in the horizontal plane. The IsoPoles also have a broader frequency coverage than any comparable antennas. Typical SWR is 1.4 to 1 or better across the entire band!

All mounting hardware is stainless steel. The decoupling cones and radiating elements are made of corrosion-resistant aluminum alloys. Aerodynamic cones are the only appreciable wind load and are attached directly to the support (a standard TV mast, not supplied).

IsoPoles are ideal for packet radio. The decoupling cones stop computer hash picked up by the outer shield of the coaxial cable from being passed to the receiver.

## Amateur TV



### AEA's New ATV System

Add a new dimension to your amateur radio communications with AEA's Amateur Television (ATV) system. If you hold at least a technician-class license, you can transmit and receive live or taped audio and video Fast-Scan TV (FSTV) information that rivals broadcast quality. Now you can share more than conversation over the air with this new mode of "personal communications."

**It's Easy and Inexpensive.** If you have a video camera or camcorder and a standard TV set, you may already own the most expensive components of an ATV system. AEA's ATV system includes a transceiver and antenna. Simply connect the camera, TV and the antenna to the transceiver, and you're on the air LIVE with one watt P.E.P.! If you want to broadcast with more power, AEA also offers a 50 watt mast-mounted linear amplifier and GaAsFET preamp with power supply. Your TV set will monitor your transmitted and received pictures.

Amplifier Now Available.

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CIRCLE 65 ON READER SERVICE CARD

# The Roll-Up 10–20 Antenna

## *Just right for portable QRP.*

by Jay M. Jeffery WV8R

The biggest problem I had to face when I decided to assemble a self-contained, portable station was the choice of an antenna. Since the station was QRP, I knew that the antenna must be as efficient as possible, yet relatively compact. Experiments with shortened antennas requiring loading coils, antennas made of coiled wire, and small loop antennas, were not encouraging. The only thing I hadn't tried was a full-size wire antenna.

Full-size wire antennas get quite large for wavelengths greater than 20 meters. Sticking to bands in the 10 through 20 meter range, I could use an antenna about 16 feet long per leg which could be easily hung on convenient projections and completely rolled up for easy carrying.

### Designing the Antenna

Of course, the length for a quarter-wave on 20 meters CW should be about 16'8". But what about the other quarter-wave needed to form the second leg of the dipole, or to act as a counterpoise?

Other problems: How could the antenna length be varied so that the VSWR can be controlled without a tuner? How could the length be varied to accommodate other bands?

Not wanting to carry around all sorts of wires cut for different requirements, I hit on the idea of terminating the wire with a coil of additional wire wound on my hand. (Using the hand as a coil form has many advantages, especially when you have to wind and unwind the coil in the field.)

Since the wire is handled often, and since it will be near the operator and other people, it must be insulated and flexible enough for easy coiling. A good quality zip cord (like a lamp cord) meets these specifications.

The antenna I built worked very well indeed. The coil behaved like a slight top loading, and effectively terminated the length of wire. By rolling and unrolling the coil, I could precisely change the effective length. As an added benefit, the top loading somewhat shortened the length of the antenna, but not enough to affect efficiency.

The final form of the antenna consists of two legs terminated by rolls of the same insulated wire. The rolls should be formed so that the legs are slightly longer than the length normally required for 20 meter operation. Once you determine this coil size by trial and error, you can tape the roll more or less permanently. New turns may be added or taken away to change the frequency or to adjust the VSWR.

You can determine the band locations by experiment and mark them with a piece of tape so you can easily locate them in the future.

### Setting Up for Operation

The simplest way to use the roll-up antenna is to hang one leg up—the leg connected to the center conductor—on the top of a door, or any handy projection, and snake the other leg—braid side—around on the floor or the ground. Then adjust the rolls and hold them in place with a wire rubbish bag tie along with a piece of #14 insulated house wire. House wire is handy because it can also serve as a hook to hold up the antenna. In this form, it is a sloper (see Figure 1). If you can get it high enough, it becomes a vertical.

You can also use the roll-up as a standard dipole or in a horizontal vee configuration for a little gain.

Since I operate QRP, I only use about 6" of coax between the transmitter and the legs of the antenna. If I plan to use more power, I extend the length of the coax so that the antenna is as far from me as possible, reducing the exposure to radiation. Also, with more power and longer coax, it's easier to use a tuner than to try to find the new resonant positions.

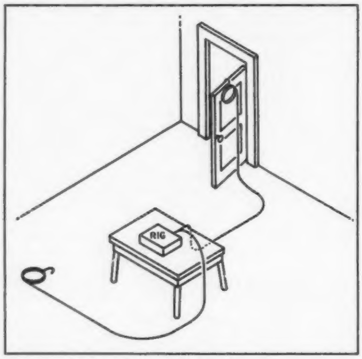

*Figure 1. Set-up using the door as a convenient projection.*

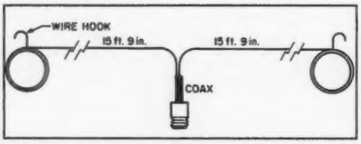

*Figure 2. Using the hand as a coil form has many advantages, especially in the field.*

(Incidentally, the roll-up was intended for QRP rather than high power, so take care if you're going to use a "hot" antenna near people. Even with insulated wire, there's a danger.)

The antenna doesn't work well in steel frame buildings, houses with aluminum siding, and so forth. If you have shielding in the construction, you have to get the antenna outside.

For 20 meters, the length of each leg is about 15'9". The 15 meter mark is at 9'9" and the 10 meter mark at 6'8". The estimates for 17 and 12 meters are 10'11" and 8'11", respectively. However, these should be determined experimentally.

With a tuner and a little more power, the roll-up will work on 30 and 40 meters.

Each leg should be made from 32 feet or more of one of the two wires that make up a zip cord. I used 32 feet of insulated wire, split apart carefully in order to avoid bare spots. Tape should, of course, be applied to any bare spots that appear, and the ends should be insulated. I made the legs of the dipole 15'9" each, up to the point where the rolls were to begin. The excess wire was then hand-wound to form the rolls. The legs were connected to the coax, which was terminated in an appropriate plug, in this case a PL-259. Figure 2 shows the outspread, complete antenna in dipole form.

If your transmitter doesn't have a built-in SWR meter, you'll have to connect it to an external meter. Otherwise, you'll have to find some other means of determining what's happening, such as using a field-strength meter.

### Performance

The roll-up works well on SSB or CW QRP, but sometimes I have to spend a little time adjusting it for the conditions. Often, by bunching up the counterpoise or spreading it out better, I can compensate for using a different rig or setting.

My favorite place for using this antenna is the front porch, in summer. There is a flower hook in just the right spot in the ceiling for hanging the antenna. Every once in a while something works out without planning, like that hook.

Building this antenna is a simple project, and if you're a QRP buff, a very useful one. Even QRO types can get some fun out of it.

---

*Jay Jeffery WV8R, 3819 Parkdale Rd., Cleveland Hts. OH 44121*

# Food for thought.

Our new Universal Tone Encoder lends its versatility to all tastes. The menu includes all CTCSS, as well as Burst Tones, Touch Tones, and Test Tones. No counter or test equipment required to set frequency - just dial it in. While traveling, use it on your Amateur transceiver to access tone operated systems, or in your service van to check out your customers' repeaters; also, as a piece of test equipment to modulate your Service Monitor or signal generator. It can even operate off an internal nine volt battery, and is available for one day delivery, backed by our one year warranty.

- All tones in Group A and Group B are included.
- Output level flat to within 1.5db over entire range selected.
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| 71.9 XA | 94.8 ZA | 123.0 3Z | 162.2 5B |
| 74.4 WA | 97.4 ZB | 127.3 3A | 167.9 6Z |
| 77.0 XB | 100.0 1Z | 131.8 3B | 173.8 6A |
| 79.7 SP | 103.5 1A | 136.5 4Z | 179.9 6B |
| 82.5 YZ | 107.2 1B | 141.3 4A | 186.2 7Z |
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# Working the World with 2 Milliwatts

## The ultimate QRP challenge.

by John Devon KI6DQ

What enables a puny 2 milliwatt signal, representing a power 300 times smaller than a flashlight, to carry intelligence halfway around the world? Bob Moody K7IRK of Palestine, Texas, may have a clue. He and his tiny "Fire-Ball" transmitter at 2 milliwatts have worked countries as far away as Argentina, Switzerland, and Russia, as well as all fifty American states.

When asked why he did it, all he said was, "It takes a warped individual to try a project like this." Moody and Bill Smith WA6YPE, who together sell the Fire-Ball, have formed a user's fraternity to encourage and enable others to accomplish Moody's feat.

### Worked All States

It took one year, 27 days, one hour, and 15 minutes, but on April 19, 1990, Moody worked Nebraska, his last state for WAS (Worked All States). Moody says, "Phil KB0FNH was patient enough to dredge through the 40 meter QRM (interference) and copy the 2 mW signal." He just received his last QSL, Michigan, in early July, allowing him to apply for WAS. Some QSLs proved difficult; he told one man he would crawl to his doorstep with BC-610s (WWII vintage heavy metal) strapped on his back to get a QSL. Is that desperate?

### QRPppp..

Perhaps his most dramatic achievement was a certificate from the QRP Amateur Radio Club, International (QRP ARCI) for over 218 million miles per watt between Glendora, California, and Palestine, Texas, using less than *6 microwatts! [On 9/9/90 I made a two-way Fire-Ball QSO with Bob K7IRK from the W2NSD/1 club station here at 73. I actually heard his 10 microwatt signal just before the band folded for a 150 million miles per watt contact!—WB8ELK/1]*

*Photo A. Bob Moody K7IRK operating his Fire-Ball rig.*

What remarkable equipment did Moody use? His original transmitter was a keyed computer clock oscillator for 28.636 MHz, teamed with a TS-820 and beam antenna. Moody said the beam was a hand-me-down which had fallen off a tower. "I patched it back together with hose clamps, copper, and aluminum tubing, and stuck it back up in the air on top of a telephone pole." Hardly a high tech effort. However, Moody used a Tektronix 2213 oscilloscope to measure the little rig's output voltage into a 50-ohm load to calculate his output power.

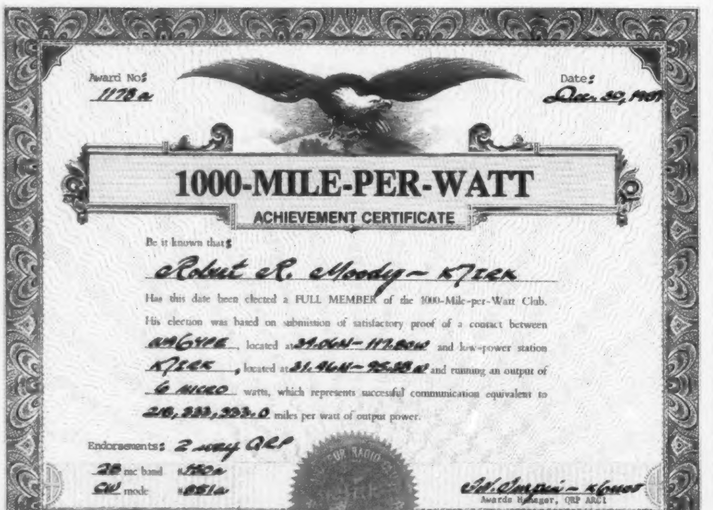
Bill Smith WA6YPE of Glendora, California, was his partner for many low-power experiments. Moody said they would link up and then reduce power until communication ceased. "We were able to communicate every day with less than 2 milliwatts between Palestine, Texas, and Glendora, California."

They created signal strength plots using an old x-y plotter that Moody picked up at a swapmeet, getting on the air for an hour from 2300Z "until the band went out." Smith would then send Moody a solid carrier at 3 watts for seven minutes, identify himself, and then send a signal for seven more minutes. They learned that the band would exhibit rapid gains and losses in signal strengths toward the end of the day.

Smith said, "We were able to use these plateaus that were maybe 20 seconds long as the times we were able to transmit and receive over this distance." He learned when to tell Moody to transmit just by how the band sounded.

### Far-Reaching Interest

Interest in their experiments even reached across the Pacific Ocean. Moody's Hawaiian contact, George Susterich KH6DXO, president of the Kauai Amateur Radio Club, recalled talking with him on CW. "It was real solid, clear copy." Susterich also remembered his own milliwatting efforts: "Nobody else would listen to a weak signal like that," except for his neighbor, four blocks away.



Award No: 1178a

Date: Dec. 30, 1989

1000-MILE-PER-WATT

ACHIEVEMENT CERTIFICATE

Be it known that: Robert R. Moody – K7IRK

Has this date been elected a FULL MEMBER of the 1000-Mile-per-Watt Club. His election was based on submission of satisfactory proof of a contact between WA6YPE, located at 34.06N – 117.80W and low-power station K7IRK, located at 31.46N – 95.58W and running an output of 6 MICRO watts, which represents successful communication equivalent to 218,333,333.0 miles per watt of output power.

Endorsements: 2 way QRP

28 mc band #150a

CW mode #851a

Awards Manager, QRP ARCI

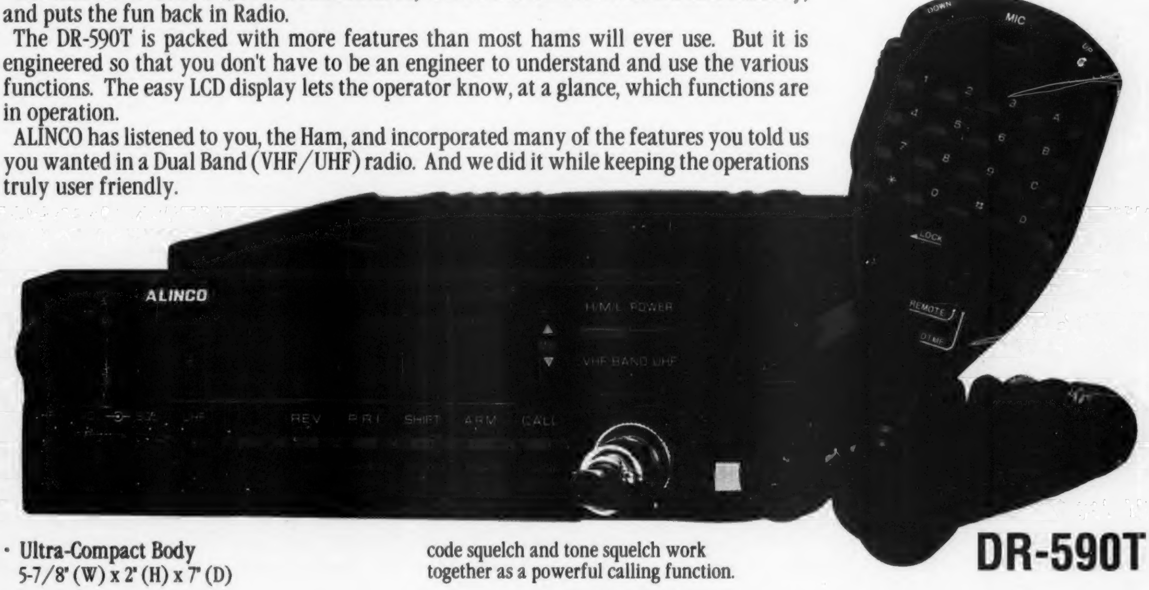
*Photo B. World Record award for 218,333,333 miles per watt!*

# THE REMOTABLE TWIN BANDER

The ALINCO Model DR-590T is a full featured/dual band tranceiver that is user friendly, and puts the fun back in Radio.

The DR-590T is packed with more features than most hams will ever use. But it is engineered so that you don't have to be an engineer to understand and use the various functions. The easy LCD display lets the operator know, at a glance, which functions are in operation.

ALINCO has listened to you, the Ham, and incorporated many of the features you told us you wanted in a Dual Band (VHF/UHF) radio. And we did it while keeping the operations truly user friendly.



## DR-590T

- **Ultra-Compact Body**
  5-7/8" (W) x 2" (H) x 7" (D)
- **High Power (Selectable)**

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  8. Setting and Automatic Dialer
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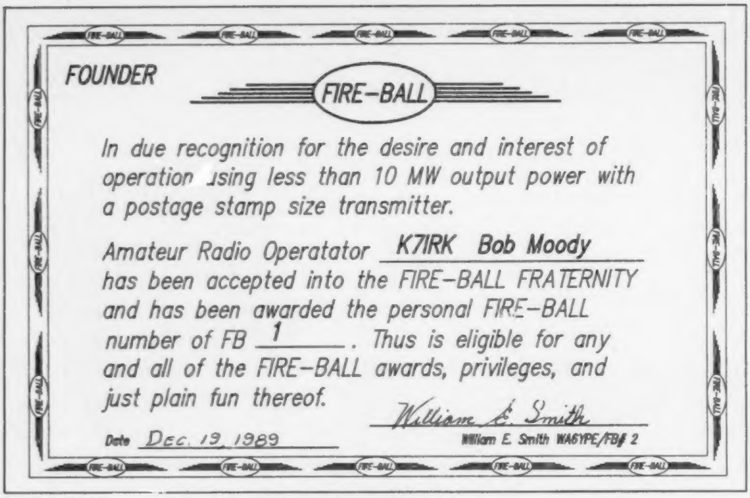

FOUNDER

FIRE-BALL

In due recognition for the desire and interest of operation using less than 10 MW output power with a postage stamp size transmitter.

Amateur Radio Operatator K7IRK Bob Moody has been accepted into the FIRE-BALL FRATERNITY and has been awarded the personal FIRE-BALL number of FB 1. Thus is eligible for any and all of the FIRE-BALL awards, privileges, and just plain fun thereof.

Date Dec. 19, 1989

William E. Smith

William E. Smith WA6YPE/FB# 2

*Photo C. Fire-Ball certificate.*

Jack McKenzie N7HQQ of Newport, Oregon, became a "Fire-Baller" after listening to Moody and Smith on 28.636 MHz. This became the Fire-Ball fraternity calling frequency, as it was conveniently located in the 10 meter phone segment. It was also Moody's computer clock oscillator's frequency. Most contacts were made on single sideband (SSB), and the milliwatt rig was then switched in for a CW contact. The production Fire-Ball operates on 28.060 MHz, the 10 meter QRP frequency.

When McKenzie got his rig, it had no name. When he got on the air and said, "I'm on with the Fire-Ball," the name stuck. On December 1, 1989, McKenzie worked JM1PPQ in Japan with his rig, after initiating the contact on SSB at an unreasonably powerful 1½ watts!

McKenzie, who works QRP "almost exclusively," notes one of the drawbacks of milliwatting: "People don't realize what you can do with the low power, and some of them almost come out and call you a liar when you tell them!"

People enjoy very low power operation, McKenzie added, because routine becomes challenge. If he talked to New York on 100 watts, it was ordinary; but, "If I do it with less than a watt, or on 10 milliwatts, I've accomplished something."

**More QRP Fraternity**

Another Fire-Baller, Dick Pursley ND3G of Greensboro, Maryland, started milliwatting from working with Bill Smith. He later worked an Oregon station, both of them using Fire-Balls on 28.060 MHz.

Since the Fire-Ball comes without a case, Pursley mounted his, complete with battery, in a L'Eggs™ pantyhose container. Although his luck was not as good as McKenzie's, he still worked over 3000 miles. As he said, "It's really a tremendous thrill when you make a contact with it."

One contact involved a Swedish milliwatter who Pursley contacted with 5 watts. The Swedish station ran 500 milliwatts and Pursley had no trouble copying him. "Absolutely Q-5, he was probably 549 or 539." Pursley scheduled a contact with him for the following week to try out his Fire-Ball, but the vagaries of propagation prevented a second contact.

Pursley has been an amateur for 13 years. Echoing Susterich, he said one of the secrets is simply to have people willing to listen for the signal. Atmospheric conditions also play a major part, he emphasized. "Without the band cooperating, you can forget it; at times even with 100 watts, you can forget it."

At the time of this writing, 10 meters has entered into what Pursley called "the summer doldrums." He looks forward to this fall, when he believes many people will be on the air with the Fire-Ball transmitters. Throughout his amateur career, he says, he gets the most pleasure from milliwatting. "It's really a thrill. This really gets your blood pumping when you work someone that's running 10 milliwatts, and so are you."

Fred Turpin K6MDJ of Cedarpines Park, California, former awards manager for the QRP Amateur Radio Club, International (QRP ARCI), issued Moody's 1000 Mile-per-Watt awards.

Turpin credits Moody's successes to operation during the "surge" prior to band shutdown. "There's a definite window there, just before the band shifts, that's wide open."

**Good Atmospherics**

The latest published propagation reports suggest that the sunspot cycle peaked during 1990. Peak years aid no one more than the low-power DXers, and show up most dramatically on 10 meters. Turpin said that while it's a heyday now, when the sunspot cycle diminishes and foreign contacts come with difficulty, QRPers "start leaning into their rigs"; they use higher power.

Despite this sober viewpoint, Turpin has enjoyed milliwatting more than most. For the 1984 Hootowl Sprint, he built a handbook 700 mW transmitter, and he remembers working about 20 states with it. It was "about the best thing I ever achieved."

Another time, he said, he borrowed a 750 mW walkie-talkie for 40 meters, and worked the whole East Coast one night on sideband (voice).

Moody also gives due credit to sunspot-influenced atmospherics. "There are times when the bands are extremely hot, and we just happened to hit the peak of the peak." He believes that anybody with modest equipment should give it a try just to see how far they can go. Getting started requires only the twist of a knob to reduce power, or a milliwatt transmitter such as the Fire-Ball. *[Ed Note: See the Fire-Ball construction article in this issue.]* Smith and Moody had so much fun milliwatting, they went into business selling the little transmitters. Moody builds them, and Smith handles the paperwork. Those interested in acquiring a kit or pre-built Fire-Ball may contact Bill Smith, Smith Enterprises, 408 E. Mauna Loa, Glendora CA 91470 Phone: (818) 963-0079, or listen for the gang on 28.060 or 28.636 MHz around 2300Z to band closure. ■

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*You may contact John Devon, technical editor for* QRP Quarterly, *at PO Box 3236, South Pasadena CA 91031.*

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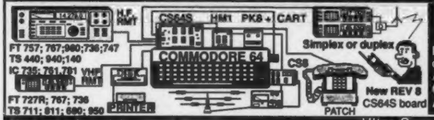

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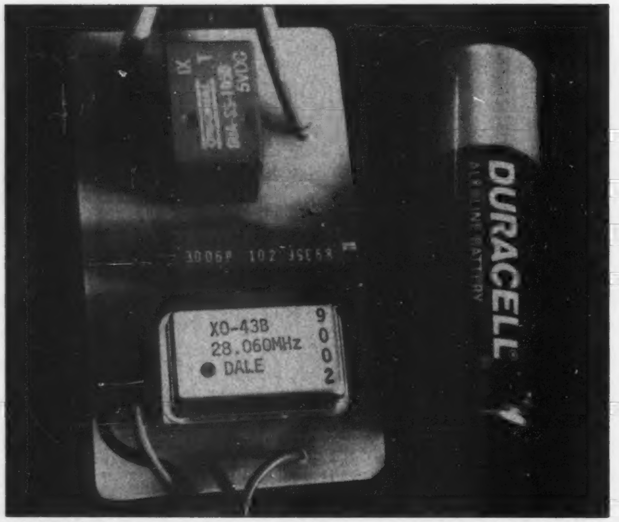
# The FIRE-BALL QRP Rig

## *50 milliwatts of pure power.*

by Bill Brown WB8ELK



*The FIRE-BALL, a battery-operated QRP rig, is powerful in the right hands. Note its size relative to the AA battery. (Photo by Elizabeth M. Devon.)*

Look inside of most computers and you may see a metal-cased IC with a frequency stamped on it. This little wonder is a complete TTL crystal oscillator circuit, all hermetically sealed in a package the size of a 14-pin IC. If you look carefully in the parts bins at your local hamfest, you may find a pile of these oscillators. It turns out that some of them resonate in the ham bands!

Bob Moody K7IRK found a few of these gems at the local surplus house on 28.636 MHz (a popular computer frequency). Although they are designed for 5-volt operation, he found that he could run his off of four AA batteries (6 volts) and obtain nearly 50 milliwatts of output. With the addition of a 1k potentiometer to adjust the power level, and a relay to allow break-in operation, Bob came up with the FIRE-BALL QRP rig (see Figure 1). The output power can be adjusted from a high setting of 50 or 60 milliwatts down to a very low 100 microwatts for those ultimate QRP contacts.

Fifty milliwatts may not sound like much to work with, but during a good band opening you can really make some solid contacts and actually move S-meters up a few notches. Recently I tried to listen for Bob's signal clear down into the low microwatt levels. I was actually able to hear a faint but readable signal at 10 microwatts. The distance between Bob's QTH in Palestine, Texas, and our location in Hancock, New Hampshire, is 1502 miles. This works out to over 150 million miles per watt! When he turned the rig back up to 2 milliwatts, it was just like he'd fired up a high power linear amp!

### Construction

Only three components comprise the FIRE-BALL. The heart of the system is the crystal oscillator module (if you can't locate one in the ham bands, contact Bill Smith WA6YPE at the address given in the parts list; Bob and Bill had a bunch made for the 28.060 MHz QRP frequency). All of the corners of the module are rounded except for one pointed corner. This is pin 1 of the oscillator. Sometimes a dot is printed on the top of the module next to pin 1 as well. Pin 1 has no connection to it, pin 14 goes to +Vcc, pin 7 is ground, and pin 8 is the output.

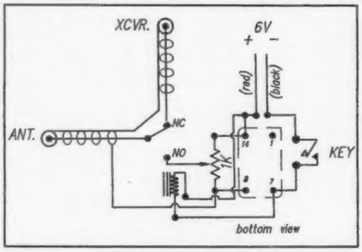


*Figure 1. FIRE-BALL schematic diagram.*

The 1k potentiometer is wired up to attenuate the output level from the rig. The rather unorthodox hookup was necessary in order to achieve maximum power from the module. Please note that you should use only battery power to run the FIRE-BALL, and you can mount it in a plastic case (Bob is still running his rig from the original battery pack after one and a half years of operation). In any case, make sure you don't hook up the battery ground lead to the coax shield. Smoke won't fly if you do this, however the maximum output power will drop to 20 milliwatts or so and the current drain will double.

Finally the T/R relay allows full break-in operation. It will handle about 100 watts from your big rig to establish your initial contact. However, if there is any SWR on your antenna system, it may be wise to limit the power through the relay to 75 watts or less.

### Calibration

You can accurately measure the output power of the FIRE-BALL if you have an

*Continued on page 21*

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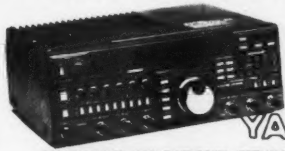

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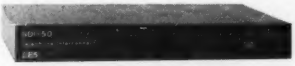

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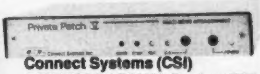

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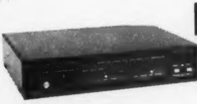

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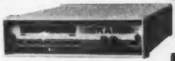

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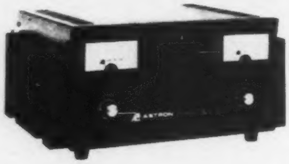

MODEL VS-50M

# ASTRON POWER SUPPLIES

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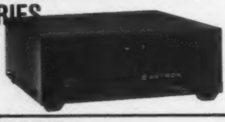
## SPECIAL FEATURES

- SOLID STATE ELECTRONICALLY REGULATED
- FOLD-BACK CURRENT LIMITING Protects Power Supply from excessive current & continuous shorted output
- CROWBAR OVER VOLTAGE PROTECTION on all Models except RS-3A, RS-4A, RS-5A, RS-4L, RS-5L
- MAINTAIN REGULATION & LOW RIPPLE at low line input Voltage
- HEAVY DUTY HEAT SINK • CHASSIS MOUNT FUSE
- THREE CONDUCTOR POWER CORD except for RS-3A
- ONE YEAR WARRANTY • MADE IN U.S.A.

## PERFORMANCE SPECIFICATIONS

- INPUT VOLTAGE: 105-125 VAC
- OUTPUT VOLTAGE: 13.8 VDC ± 0.05 volts (Internally Adjustable: 11-15 VDC)
- RIPPLE Less than 5mv peak to peak (full load & low line)
- All units available in 220 VAC input voltage (except for SL-11A)

## SL SERIES



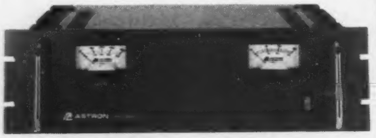
- LOW PROFILE POWER SUPPLY

| MODEL | Colors Gray | Colors Black | Continuous Duty (Amps) | ICS* (Amps) | Size (IN) H × W × D | Shipping Wt. (lbs.) |
|---|---|---|---|---|---|---|
| SL-11A | • | • | 7 | 11 | 2¾ x 7⅝ x 9¾ | 11 |

## RS-L SERIES

- POWER SUPPLIES WITH BUILT IN CIGARETTE LIGHTER RECEPTACLE

| MODEL | Continuous Duty (Amps) | ICS* (Amps) | Size (IN) H × W × D | Shipping Wt. (lbs.) |
|---|---|---|---|---|
| RS-4L | 3 | 4 | 3½ x 6⅛ x 7¼ | 6 |
| RS-5L | 4 | 5 | 3½ x 6⅛ x 7¼ | 7 |



## RM SERIES

MODEL RM-35M

- 19" RACK MOUNT POWER SUPPLIES

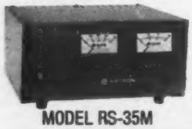
| MODEL | Continuous Duty (Amps) | ICS* (Amps) | Size (IN) H × W × D | Shipping Wt. (lbs.) |
|---|---|---|---|---|
| RM-12A | 9 | 12 | 5¼ × 19 × 8¼ | 16 |
| RM-35A | 25 | 35 | 5¼ × 19 × 12½ | 38 |
| RM-50A | 37 | 50 | 5¼ × 19 × 12½ | 50 |
| RM-60A | 50 | 55 | 7 × 19 × 12½ | 60 |
| • Separate Volt and Amp Meters | | | | |
| RM-12M | 9 | 12 | 5¼ × 19 × 8¼ | 16 |
| RM-35M | 25 | 35 | 5¼ × 19 × 12½ | 38 |
| RM-50M | 37 | 50 | 5¼ × 19 × 12½ | 50 |
| RM-60M | 50 | 55 | 7 × 19 × 12½ | 60 |

## RS-A SERIES

MODEL RS-7A

| MODEL | Colors Gray | Colors Black | Continuous Duty (Amps) | ICS* (Amps) | Size (IN) H × W × D | Shipping Wt. (lbs.) |
|---|---|---|---|---|---|---|
| RS-3A | | • | 2.5 | 3 | 3 × 4¾ × 5¾ | 4 |
| RS-4A | • | • | 3 | 4 | 3¾ × 6½ × 9 | 5 |
| RS-5A | | • | 4 | 5 | 3½ × 6⅛ × 7¼ | 7 |
| RS-7A | • | • | 5 | 7 | 3¾ × 6½ × 9 | 9 |
| RS-7B | • | • | 5 | 7 | 4 × 7½ × 10¾ | 10 |
| RS-10A | • | • | 7.5 | 10 | 4 × 7½ × 10¾ | 11 |
| RS-12A | • | • | 9 | 12 | 4½ × 8 × 9 | 13 |
| RS-12B | | • | 9 | 12 | 4 × 7½ × 10¾ | 13 |
| RS-20A | • | • | 16 | 20 | 5 × 9 × 10½ | 18 |
| RS-35A | • | • | 25 | 35 | 5 × 11 × 11 | 27 |
| RS-50A | • | | 37 | 50 | 6 × 13¾ × 11 | 46 |

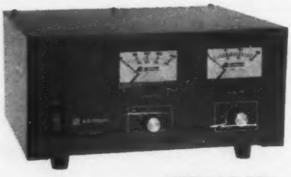
## RS-M SERIES



MODEL RS-35M

| MODEL | Continuous Duty (Amps) | ICS* (Amps) | Size (IN) H × W × D | Shipping Wt. (lbs.) |
|---|---|---|---|---|
| • Switchable volt and Amp meter | | | | |
| RS-12M | 9 | 12 | 4½ × 8 × 9 | 13 |
| • Separate volt and Amp meters | | | | |
| RS-20M | 16 | 20 | 5 × 9 × 10½ | 18 |
| RS-35M | 25 | 35 | 5 × 11 × 11 | 27 |
| RS-50M | 37 | 50 | 6 × 13¾ × 11 | 46 |

## VS-M AND VRM-M SERIES



MODEL VS-35M

- Separate Volt and Amp Meters • Output Voltage adjustable from 2-15 volts • Current limit adjustable from 1.5 amps to Full Load

| MODEL | Continuous Duty (Amps) @13.8VDC | Continuous Duty (Amps) @10VDC | Continuous Duty (Amps) @5VDC | ICS* (Amps) @13.8V | Size (IN) H × W × D | Shipping Wt. (lbs.) |
|---|---|---|---|---|---|---|
| VS-12M | 9 | 5 | 2 | 12 | 4½ × 8 × 9 | 13 |
| VS-20M | 16 | 9 | 4 | 20 | 5 × 9 × 10½ | 20 |
| VS-35M | 25 | 15 | 7 | 35 | 5 × 11 × 11 | 29 |
| VS-50M | 37 | 22 | 10 | 50 | 6 × 13¾ × 11 | 46 |
| • Variable rack mount power supplies | | | | | | |
| VRM-35M | 25 | 15 | 7 | 35 | 5¼ × 19 × 12½ | 38 |
| VRM-50M | 37 | 22 | 10 | 50 | 5¼ × 19 × 12½ | 50 |

## RS-S SERIES

MODEL RS-12S

- Built in speaker

| MODEL | Colors Gray | Colors Black | Continuous Duty (Amps) | ICS* Amps | Size (IN) H × W × D | Shipping Wt. (lbs.) |
|---|---|---|---|---|---|---|
| RS-7S | • | • | 5 | 7 | 4 × 7½ × 10¾ | 10 |
| RS-10S | • | • | 7.5 | 10 | 4 × 7½ × 10¾ | 12 |
| RS-12S | • | • | 9 | 12 | 4½ × 8 × 9 | 13 |
| RS-20S | • | • | 16 | 20 | 5 × 9 × 10½ | 18 |

*ICS—Intermittent Communication Service (50% Duty Cycle 5min. on 5 min. off)

CIRCLE 16 ON READER SERVICE CARD

*Continued from page 18*

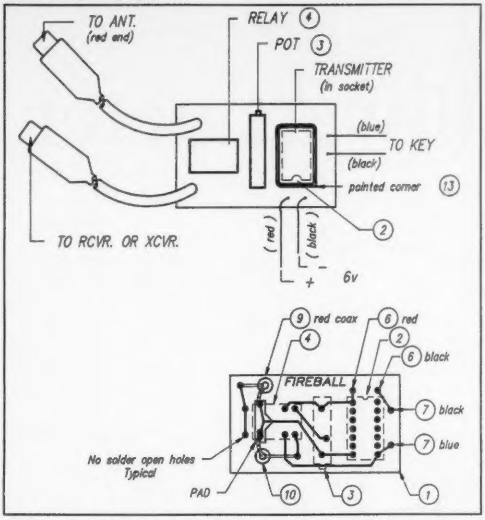


*Figure 2. (a) Parts piacement (top view) and (b) parts placement (bottom view).*

oscilloscope capable of greater than 30 MHz bandwidth. Attach your fireball up to a T-connector that is terminated with a 50-ohm dummy load. Hook this up to your scope input. Measure the peak-to-peak voltage while keying the FIRE-BALL. To determine your output power, use the following calculations:

1) Calculate peak voltage ($V_p = V_{pp}/2$)
2) Calculate RMS voltage ($V_{rms} = 0.707 \bullet V_p$)
3) Square the RMS voltage and divide by the load resistance $(V_{rms})^2/50$
4) You now have your output power in watts!

Combined formula:

**Power in Watts = $(0.707 \bullet (V_{pp}/2))^2/50$.**

Note: To check your calculations, a 2 volt peak-to-peak voltage reading indicates an output power of 10 milliwatts (0.010 watt).

If you don't have access to an oscilloscope, you can construct a 6.4 milliwatt LED standard (See Figure 4). The LED and ⅛ watt resistors can be mounted inside of a female RCA shielded plug and attached to the FIRE-BALL antenna lead for calibration. Adjust the FIRE-BALL's attenuator potentiometer until the LED barely lights. Your rig is now set for 6.4 milliwatts. Just turn the attenuator pot ½ turn to the left for a 10 milliwatt output. For more immediate readings a more elaborate calibration meter can be built (see the "Firecaler Milliwattmeter" this issue).

A quick and fairly accurate way of finding the 10 milliwatt level on the FIRE-BALL is to turn the potentiometer fully counter-clockwise for maximum power. Then turn the pot 3½ turns clockwise—you should now be very close to 10 milliwatts output.

### Operation

Hook up the two cables from the FIRE-BALL to your antenna and to your rig. Attach a CW key and prepare to have a great time chasing down milliwatt QSOs. Now that Worked All States (WAS) has been accomplished with 2 milliwatts, why not try for the milliwatt WAC or DXCC awards! ■

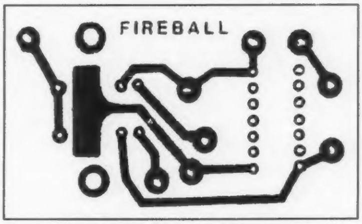


*Figure 3. PC board foil pattern.*

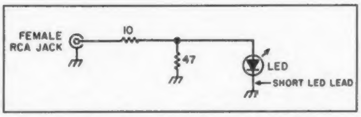


*Figure 4. 10 milliwatt LED calibrator.*

### Parts List

| | | |
|---|---|---|
| **FIRE-BALL:** | | |
| Crystal oscillator module | | |
| 1 | 1k, 15-turn pot | RS 271-342 |
| 1 | 5-volt relay | RS 275-243 |
| 2 | shielded cables | RCA plugs or BNC connectors |
| 1 | PC board | |
| **LED Calibrator:** | | |
| 1 | LED | RS 276-033 |
| 1 | 47 ohm ⅛ or ¼ watt resistor | |
| 1 | 10 ohm ⅛ or ¼ watt resistor | |
| 1 | female RCA phono jack | RS 274-338 |

A kit of all parts for the FIRE-BALL, including the PC board, crystal oscillator on 28.060 MHz, and a FIRE-BALL membership certificate is available for $24. The assembled and calibrated unit is $36. A pre-calibrated LED power standard is available for $10. Please add $2 for postage. California residents please add sales tax. To order, contact Bill Smith WA6YPE at Smith Enterprises, 408 E. Mauna Loa, Glendora CA 91740. Telephone: (818) 963–0079.

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CIRCLE 194 ON READER SERVICE CARD

# The Firecaler Milliwattmeter

## *Calibrate your mini-QRP rig.*

by Martin Beck WB0ESV

When running low milliwatt tests with the FIRE-BALL transmitter (in this issue), you need to be able to measure the output power. Not having an oscilloscope with a 30 MHz bandwidth, and only having a calibrated LED standard at 10 milliwatts, my power measurement was restricted to one value.

I tried a VTVM and RF probe, but it proved next to useless at this low power, high frequency range. Bill Smith WA6YPE mentioned this to me and I told him I thought I could design and build a meter to do the job. Thus the Firecaler (FIRE-BALL Calibrator) was born.

The Firecaler has two ranges: 0–10 mW and 0–100 mW, and operates from a 9-volt battery. It has a face plate mounted potentiometer to zero the meter as the battery voltage decreases with use. Zero the meter with no RF applied, and turn the pot dial clockwise until the pointer just reads 0—*do not go any further.* First, calibrate your FIRE-BALL to 10 mW using an LED standard (see the FIRE-BALL article in this issue). The 10 mW test signal can be obtained from a signal generator as well. Hook up the antenna output lead from the FIRE-BALL transmitter to the Firecaler power test jack. Key your transmitter and turn on the milliwattmeter. Switch to the 0–10 mW range, adjust the thumb turn pot on the right (cut a hole in the bottom of the Firecaler for easy access) to read full scale at the 0–10 mW range (full scale = 1.0 on the meter).

**PARTS**

R1 & R2 are linear taper pots
D1 & D2 are 1N914 or 1N34
.01 capacitors are disc ceramic
M1 meter is 0–1 MA. DC.
R3 is 1k, linear taper
J1,J2,J3 are RCA phono (females)
R4 = 62 ⌒ 1/4 W. matched
R5 = 240 ⌒ 1/4 W. coverd W/ spagetti
MPF–102
S1 = SPST switch
S2 = DPDT switch
TERMINAL STRIP Cut as reqd.
1/8" BRASS or COPPER TUBING x 7/8" long.
BOX 2" x 4" x 7" plastc W/ alum. face.

NOTE: MOST OF THE PARTS WITH THE EXCEPTION OF THE METER AND THE ATTENUATOR RESISTORS SHOULD BE AVAILABLE FROM RADIO SHACK INCLUDING THE PLASTC BOX WITH ALUMINUM FACE PLATE.
CUT A 1" DIA. HOLE IN BOTTOM OF BOX FOR ACCESS TO THUMB TURN POTS.

Then switch to the 0–100 mW range and adjust the left pot until the meter reads 0.1. The Firecaler is now calibrated, and you can adjust your FIRE-BALL pot to whatever RF output level you want to, or you can accurately measure the power that you were running on that last QSO—the one you made when you kept turning the power down, and the other guy was still copying you.

For those of you who really want a challenge, and work in the microwatt levels, there is also a built-in −20 dB attenuator that you can transmit through. Thus, 10 mW set on the milliwatt meter will be 100 microwatts when run through the attenuator.

### Some Don'ts

Don't transmit over 100 milliwatts through the milliwatt meter or attenuator. This means NO break-in operation. Use a manual switch in your antenna coax to switch to a receiver on receive, then switch to the FIRE-BALL with attenuator for transmitting.

Don't use an old 9V battery. The meter readings are only accurate with a good fresh battery. The Firecaler draws 5–10 mA when on, so when in doubt, give that used battery to the kids and get a fresh one.

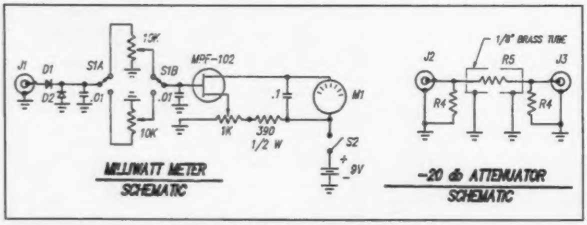
J1
D1
D2
S1A
.01
10K
10K
S1B
.01
MPF-102
1K
390
1/2 W
.1
M1
S2
+
9V
-
MILLIWATT METER
SCHEMATIC
1/8" BRASS TUBE
J2
R5
J3
R4
R4
-20 db ATTENUATOR
SCHEMATIC

Figure 1. Milliwattmeter schematic.

*Martin Beck WB0ESV, 1637 Hood, Wichita KS 67203.*

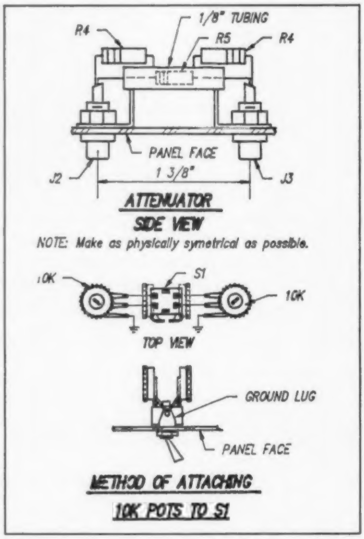
R4
1/8" TUBING
R5
R4
PANEL FACE
1 3/8"
J2
J3
ATTENUATOR
SIDE VIEW
NOTE: Make as physically symetrical as possible.
10K
S1
10K
TOP VIEW
GROUND LUG
PANEL FACE
METHOD OF ATTACHING
10K POTS TO S1

Figure 2. Attenuator and adjustment parts placement.

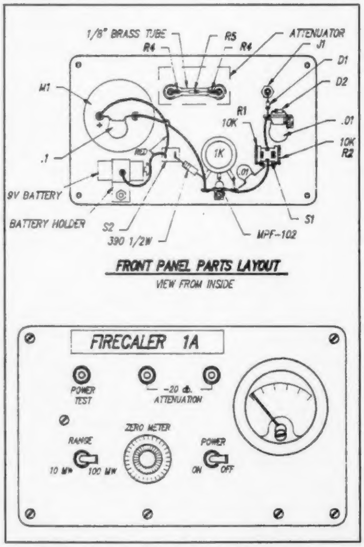
1/8" BRASS TUBE
R4
R5
R4
ATTENUATOR
J1
D1
D2
M1
R1
10K
.01
10K
R2
.1
RED
1K
.01
9V BATTERY
BATTERY HOLDER
S2
390 1/2W
MPF-102
S1
FRONT PANEL PARTS LAYOUT
VIEW FROM INSIDE
FIRECALER 1A
POWER
TEST
-20 db.
ATTENUATION
ZERO METER
RANGE
10 MW
100 MW
POWER
ON
OFF

Figure 3. Front panel parts placement.

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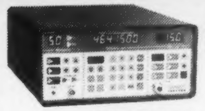
## 2 WAY RADIO SERVICE MONITOR

COM-3, the world's most popular low-cost service monitor. For shops big or small, the COM-3 delivers advanced capabilities for a fantatic price—and our new lease program allows you to own a COM-3 for less than $3.00 a day. Features •Direct entry keyboard with programmable memory •Audio & transmitter frequency counter •LED bar graph frequency/error deviation display •0.1–10.000 µV output levels •High receive sensitivity, less than 5 µV •100 kHz to 999.9995 MHz •Continuous frequency coverage •Transmit protection, up to 100 watts •CTS tone encoder, 1 kHz and external modulation.



**RSG-10**
**$2495.00**

## SYNTHESIZED SIGNAL GENERATOR

Finally, a low-cost lab quality signal generator—a true alternative to the $7,000 generators. The RSG-10 is a hard working, but easy to use generator ideal for the lab as well as for production test. Lease it for less than $3.00 a day. Features •100 kHz to 999 MHz •100 Hz resolution to 500 MHz, 200 Hz above • –130 to +10 dBm output range •0.1 dB output resolution •AM and FM modulation •20 programmable memories •Output selection in volts, dB, dBm with instant conversion between units •RF output reverse power protected •LED display of all parameters—no analog guesswork!

## FREQUENCY COUNTERS

**CT-70 7 DIGIT 525 MHz**

**CT-90 9 DIGIT 600 MHz**

**CT-125 9 DIGIT 1.2 GHz**

Ramsey Electronics has been manufacturing electronic test gear for over 10 years and is recognized for its lab quality products at breakthrough prices. All of our counters carry a full one-year warranty on parts and labor. We take great pride in being the largest manufacturer of low-cost counters in the entire U.S.A. Compare specifications. Our counters are full-featured, from audio to UHF, with FET high impedance input, proper wave shaping circuitry, and durable high quality epoxy glass plated-thru PC board construction. All units are 100% manufactured in the U.S.A. All counters feature 1.0 ppm accuracy.

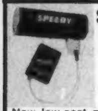
**NEW CT-250 2.5 GHZ**

### ACCESSORIES FOR COUNTERS

| | |
|---|---|
| Telescopic ship antenna—BNC plug, WA-10 | $11.95 |
| High impedance probe, light loading, HP-1 | $16.95 |
| Low-pass probe, audio use, LP-1 | $16.95 |
| Direct probe, general purpose use, DC-1 | $16.95 |
| Tilt bail, elevates counter for easy viewing, TB-70 | $ 9.95 |
| Rechargeable internal battery pack, BP-4 | $ 9.95 |
| CT-90 oven timebase, 0.1 ppm accuracy, OV-1 | 59.95 |

### ALL COUNTERS ARE FULLY WIRED & TESTED

| MODEL | FREQ. RANGE | SENSITIVITY | DIGITS | RESOLUTION | PRICE |
|---|---|---|---|---|---|
| CT-50 | 20 Hz–600 MHz | <25 mV to 500 MHz | 8 | 1 Hz, 10 Hz | $189.95 |
| CT-70 | 20 Hz–550 MHz | <50 mV to 150 MHz | 7 | 1 Hz, 10 Hz, 100 Hz | $139.95 |
| CT-90 | 10 Hz–600 MHz | <10 mV to 150 MHz<br><150 mV to 600 MHz | 9 | 0.1 Hz, 10 Hz, 100 Hz | $169.95 |
| CT-125 | 10 Hz–1.25 GHz | <25mV to 50 MHz<br><15 mV to 500 MHz<br><100 mV to 1 GHz | 9 | 0.1 Hz, 1 Hz, 10 Hz | $189.95 |
| CT-250 | 10 Hz–2.5 GHz typically 3.0 GHz | <25 mV to 50 MHz<br><10 mV to 1 GHz<br><50 mV to 2.5 GHz | 9 | 0.1 Hz, 1 Hz, 10 Hz | $239.95 |
| PS10B Prescaler | 10 MHz–1.5 GHz, divide by 1000 | <50 mV | Convert your existing counter to 1.5 GHz | | $89.95 |



## SPEED RADAR

**$89.95**
**complete kit**
**SG-7**

New low-cost microwave Doppler radar kit "clocks" cars, planes, boats, horses, bikes, baseballs, models, runners, or virtually anything that moves. Operates at 2.6 GHz with over ¼-mile range. LED digital readout displays speeds in miles per hour, kilometers per hour, or feet per second! Earphone output permits listening to actual Doppler shift. Uses two 1-lb. coffee cans for antenna (not included) and runs on 12 VDC. Easy to build—all microwave circuitry is PC stripline. Kit includes deluxe ABS plastic case with speedy graphics for a professional look. A very useful and full-of-fun kit.

## BROADBAND PREAMP

Boost those weak signals to your scanner, TV, shortwave radio or frequency counter. Flat 25 dB gain, 1 to 1000 MHz. 3 dB NF. BNC connectors. Runs on 12 VDC or 110 VAC.
PR-2, wired, includes AC adapter ........ $59.95

## 2M POWER AMP

Easy to build power amp has 8 times power gain, 1W in, 8W out, 2W in, 16W out, 5W is for 40W out. Same amp as featured in many ham magazine articles. Complete with all parts, less case and T-R relay.

PA-1, 40W pwr amp kit ...... $29.95
TR-1, RF sensed T-R relay kit . $ 8.95

## FM WIRELESS MIKE KITS

FM-3 SHOWN

Pick the unit that's right for you. All units transmit stable signal in 88–108 MHz FM band up to 300′ except for hi power FM-4 that goes up to ½ mile.

FM-1, basic unit ............ $ 5.95
FM-2, as above but with added mike preamp ................ $ 7.95
FM-4, long range, high power with very sensitive audio section, picks up voices 10′ away ........ $14.95
FM-3, complete unit includes case, battery, switch, antenna, and built-in condensor mike. Excellent fidelity, very small, kit ............ $16.95
FM-3WT, as above, but fully wired and tested ............... $19.95
SMC, miniature sensitive mike cartridge for FM-1, 2, 4 ......... $ 2.95

**MICROWAVE INTRUSION ALARM**
A real microwave Doppler sensor that will detect a human as far as 10 feet away. Operates on 1.3 GHz, and is not affected by heat, light, or vibrations. Drives up to 100 mA output, normally open or closed, runs on 12 VDC.
Complete kit MD-3 . $16.95

**MUSIC MACHINE**
Neat kit that will produce 25 different classical and popular tunes, plus 3 doorchime sounds. Lots of fun for doorbells, shop, or store entrances, car horn, music boxes, etc. Runs on 9V battery or wall transformer. Excellent speaker volume and adjustable tempo and pitch. Add our case set for a handsome finished look.
Complete kit, MM-5 ...... $24.95
Case + knob set, CMM-5 . $12.95

**PACKET RADIO**
Commodore C64/128 packet radio interface. Uses famous German Digicom software. Features EXAR IC chip set for reliable operation—runs HF or VHF tones. Includes FREE disk software. PC board, all necessary parts and full documentation.
Complete kit, PC-1 .... $49.95

**LO NOISE PREAMPS**
Make that reciever come ALIVE! Small size for easy installation with Hi-Q tuned input for peak performance. Excellent gain and noise figure—guaranteed to improve reception! Specify band: 2M—PR-10, 220 MHz—PR-20, 440 MHz—PR-40.
Each kit .......... $17.95

**TONE DECODER**
A complete tone decoder on a single PC board. Features: 400–5000 Hz adjustable range via 20-turn pot, voltage regulation, 567 IC. Useful for touch-tone burst detection, FSK, etc. Can also be used as a stable tone encoder. Runs on 5 to 12 volts.
Complete kit, TD-1 . $5.95

**VOICE ACTIVATED SWITCH**
Voice activated switch kit provides switched output with current capability up to 100 mA. Can drive relays, lights, LED, or even a tape recorder motor. Runs on 9 VDC.
VS-1 kit. ...... $6.95

**TELEPHONE TRANSMITTER**
Mini-sized with professional performance. Self-powered from phone line, transmits in FM broadcast band up to ¼ mile. Installs easily anywhere on phone line or inside phone!
PB-1 kit ...... $14.95

**TICKLE STIK**
A shocking kit! Blinking LED attracts victims to pick up innocent-looking can—you watch the fun! Ideal for office desks, parties, nosey know-it-alls!
TS-4 kit ....... $9.95

**TV TRANSMITTER**
Transmit your VCR or TV camera throughout your house. Stable quality signal, tunable Ch 4–6. Accepts standard video and audio inputs.
Complete kit,
JM-7 ........ $14.95

**COLOR ORGAN**
See music come alive! 3 different lights flicker with music. One light each for high, mid-range, and lows. Each individually adjustable and drives up to 300 W. Runs on 110 VAC.
ML-1 kit. ...... $8.95

**LIGHT BEAM COMMUNICATORS**
Transmits audio over infrared beam up to 30′—use simple lenses to go up to ¼ mile! Hum free, uses 30 kHz carrier. Great for wireless earphones or undetectable "bug."
Transmitter + receiver set, LB56 . . $19.95

**FM RADIO**
Full-fledged superhet, microvolt sensitivity, IC detector and 10.7 MHz IF. Tunes Std. FM broadcast band as well as large portions on each end. Ideal for "bug" receiver, hobby experiments or even as FM radio!
FR-1 kit ...... $14.95

**SUPER SLEUTH**
A super sensitive amplifier which will pick up a pin drop at 15 feet! Great for monitoring baby's room or as general purpose amplifier. Full 2W rms output. Runs on 6 to 15 volts, uses 8–45 ohm speaker.
BN-9 kit ...... $5.95

**BROADBAND PREAMP**
Very popular sensitive all-purpose preamp, ideal for scanner, TVs, VHF/UHF rigs, counters. Lo noise, 20 dB gain, 100 kHz–1 GHz, 9V–12 VDC operation.
SA-7 kit ...... $14.95

NEW

# FANTASTIC 2M FM TRANSCEIVER

## SYNTHESIZED—NO CRYSTALS TO BUY!

**$129.95**

Ramsey breaks the price barrier on 2 meter rigs! Here's the ideal rig for field days, hamfests, vacations, second cars and packet (it even has dedicated packet connections). Six expandable diode-programmed channels, 5W RF output, sensitive dual conversion receiver and EASY assembly. Why pay more for a secondhand old rig when you can make your own for less. Have some fun with your own truly AMERICAN-MADE FM rig! This kit comes complete except for the case, mike and speaker—ICOM or equal speaker-mikes plug right in. Add our own beautiful case set for a professional factory look.

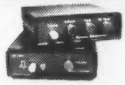
FTR-146 kit ........................ $129.95
FTR-146-C aluminum case & knob set ........ $24.95

**2 M & 220 BOOSTER AMP**

Here's a great booster for any 2 meter or 220 MHz hand-held unit. These power boosters deliver over 30 watts of output, allowing you to hit the repeater's full quieting while the low noise preamp remarkably improves reception. Ramsey Electronics has sold thousands of 2 meter amp kits, but now we offer completely wired and tested 2 meter, as well as 220 MHz, units. Both have all the features of the high-priced boosters at a fraction of the cost.

PA-10 2 MTR POWER BOOSTER (10 X power gain)
Fully wired & tested ........................ $79.95
PA-20 220 MHz POWER BOOSTER (8 X power gain)
Fully wired & tested ........................ $79.95

## QRP TRANSMITTERS HAM RECEIVERS



### 20, 30, 40, 80M CW TRANSMITTERS

Join the fun on QRP! Thousands of these mini-rigs have been sold and tons of DX contacts have been made. Imagine working Eastern Europe with a $30 transmitter—that's ham radio at its best! These CW rigs are ideal mates to the receivers at right. They have two-position variable crystal control (one popular QRP XTAL included), one watt output and built-in antenna switch. Runs on 12VDC. Add our matching case and knob set for a handsome finished look.

Your choice of bands ............ $29.95
(Specify band: QRP-20, 30, 40 or 80)
Matching case & knob set, CQRP ........ $12.95

### 20, 30, 40, 80M All Mode RECEIVERS

Build your own mini ham station. Sensitive all-mode AM, CW, SSB receivers use direct conversion design with NE602 IC as featured in *QST* and ARRL handbooks. Very sensitive varactor tuned over entire band. Plenty of speaker volume. Runs on 9V battery. Very EASY to build, lots of fun and educational—ideal for beginner or old pro. New 30-page manual. Add the case set for well-fitted professional look.

Your choice of bands ............ $27.95
(Specify band: HR-20, HR-30, HR-40, HR-80)
Matching case & knob set, CHR ........ $12.95

## E-Z KEY CMOS KEYER

Send perfect CW within an hour of receiving this kit! Easy-to-build kit has sidetone oscillator, speed control and keys most any transmitter. Runs for months on a 9V battery. 28-page manual gives ideas on making your own key for extra savings. Add our matching case set for complete station look.

CW-7 kit ........................ $24.95
Matching case knob set, CCW ........ $12.95

## ACTIVE ANTENNA

Cramped for space? Get longwire performance with this desktop antenna. Properly designed unit has dual HF and VHF circuitry and built-in whip antenna, as well as external jack. RF gain control and 9V operation makes unit ideal for SWLs, traveling hams or scanner buffs who need hotter reception. The matching case and knob set gives the unit a hundred dollar look!

AA-7 Kit ........................ $24.95
Matching case & knob set, CAA ........ $12.95

## SPEECH SCRAMBLER

Communicate in total privacy over phone or radio. Kit features full duplex operation using frequency inversion. Both mike and speaker or line in/out connections. Easy hookup to any radio, and telephone use requires no direct connection! Easy to build 2 IC circuit. Can also be used to descramble many 2-way radio signals. Finish your kit off with the handsome case & knob set.

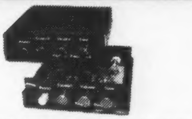
SS-7 kit ........................ $29.95
Matching case & knob set, CSS ........ $12.95

## SHORTWAVE RECEIVER

Fantastic receiver that captures the world with just a 12" antenna! Can receive any 2 MHz portion from 4–11 MHz. True superhet has smooth varactor tuning, AGC, RF gain control, plenty of speaker volume and runs on a 9V battery. Fascinating Scout, school or club project provides hours of fun for even the most serious DXer. For the car, consider our shortwave converter. Two switchable bands (in 3–22 MHz range), each 1 MHz wide—tunable on your car radio dial. Add some interest to your drive home!

Shortwave receiver kit, SRI ........ $27.95
Shortwave converter kit, SCI ........ $24.95
Matching case set for SRI, CSR ........ $12.95
Matching case set for SCI,CSC ........ $12.95

## 2, 6, 10 MTR, 220 FM RECEIVERS

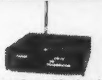


Keep an ear on the local repeater gang, monitor the cops, check out the weather or just plain listen around. These sensitive superhet receivers are just the ticket. They tune any 5 MHz portion of the band and have smooth varactor tuning, dual conversion with ceramic IF filters, AFC, adjustable squelch and plenty of speaker volume. Runs on 9V battery and performance that rivals the big rigs! For a complete finished pro look, add our matching case and knob set with screened graphics.

FM communications receiver kit ........ $29.95
Specify band: FR 146 (2m), FR6 (6m), FR10 (10m), FR-220 (220 MHz)
Matching case & knob set, CFR ........ $12.95

## FM STEREO TRANSMITTER

**STEREO**



Run your own stereo FM station! Transmit a stable signal in the standard FM broadcast band throughout the house, dorm or neighborhood. Connects easily to line outputs on CD player, tape decks, etc. Runs on 9V battery, has internal whip antenna and external antenna jack. Add our case set for a "station" look!

FM-10 kit ........................ $29.95
Matching case set, CFM ........ $12.95

## AIRCRAFT RCVR

Hear exciting aircraft communications—pick up planes up to 100 miles away! Receives 110–136 MHz AM air band, smooth varactor tuning superhet with AGC, ceramic filter, adjustable squelch, excellent sensitivity and lots of speaker volume. Runs on 9V battery. Great for air shows or just hanging around the airport! New 30-page manual details pilot talk, too. Add case set for "pro" look.

AR-1 kit ........................ $24.95
Matching case set, CAR ........ $12.95

TERMS Satisfaction guaranteed examine for 10 days. If not pleased, return in original form for refund. •Add 7% (up to a maximum of $10) for shipping, handling and insurance. •For foreign orders add 15% for surface mail. •COD (USA only), add $4.50. •Orders under $20, add $3.00. •NY residents, add 7% sales tax. •90-day parts warranty on kits. •1-year parts & labor warranty on wired units.

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**RAMSEY ELECTRONICS, INC. 793 Canning Parkway, Victor, NY 14564**

**CIRCLE 34 ON READER SERVICE CARD**

# The Smoke Detector Receiver

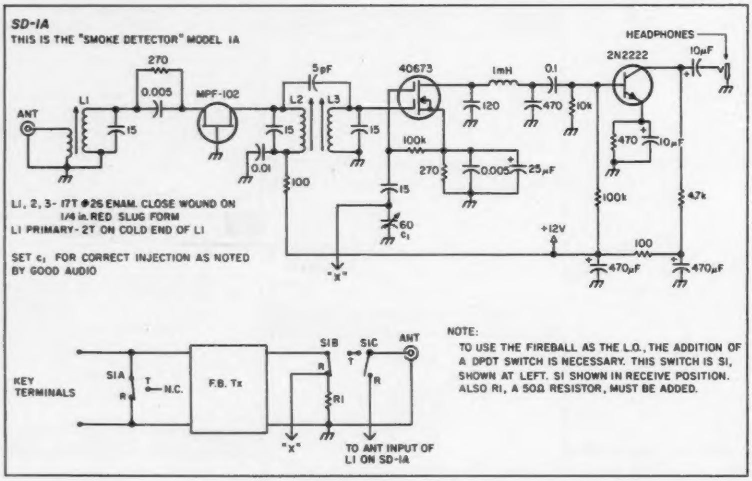
## Turn the FIRE-BALL into a complete transceiver.

by Martin Beck WB0ESV

While building the FIRE-BALL QRP rig (see the FIRE-BALL QRP article this issue), I decided it would be great to have a companion mini-receiver. After some experimentation one night, I developed the "Smoke-Detector" receiver which hooks up directly to the FIRE-BALL transmitter. With the addition of a switch and a pair of headphones, I now have a miniature crystal-controlled transceiver which I can take just about anywhere!

### Circuit Description

I designed the receiver to use a minimum amount of components but still provide good performance. During receive, the output of the FIRE-BALL is used as the local oscillator (L.O.) input to a 40673 mixer stage. The received signal is amplified by the MPF102 preamplifier stage and mixed with the FIRE-BALL L.O. signal in the 40673. The resulting direct conversion audio is amplified to headphone levels by a 2N2222 audio stage.


SD-IA
THIS IS THE "SMOKE DETECTOR" MODEL IA
ANT
L1
270
0.005
MPF-102
15
0.01
100
5pF
L2
L3
15
15
40673
1mH
0.1
120
470
10k
100k
270
0.005
25μF
15
60
C1
+12V
2N2222
HEADPHONES
10μF
470
10μF
100k
4.7k
100
470μF
470μF
"X"
KEY TERMINALS
S1A
T
R
N.C.
F.B. Tx
S1B
S1C
R
T
R
R1
ANT
"X"
TO ANT INPUT OF L1 ON SD-IA

L1, 2, 3- 17T #26 ENAM. CLOSE WOUND ON 1/4 in. RED SLUG FORM
L1 PRIMARY- 2T ON COLD END OF L1

SET C1 FOR CORRECT INJECTION AS NOTED BY GOOD AUDIO

NOTE:
TO USE THE FIREBALL AS THE L.O., THE ADDITION OF A DPDT SWITCH IS NECESSARY. THIS SWITCH IS S1, SHOWN AT LEFT. S1 SHOWN IN RECEIVE POSITION. ALSO R1, A 50Ω RESISTOR, MUST BE ADDED.

*Figure 1. Schematic diagram of the Smoke Detector receiver.*

### Construction

Construction was done on perfboard with point-to-point-wiring. L1, L2 and L3 consist of 17 turns #26 enamel-covered magnet wire close wound on a ¼" J.W. Miller coil form with a red tuning slug. The primary of L1 is 2 turns of #26 enameled wire wound around the cold end (ground end) of L1. If the J.W. Miller coil forms are difficult to obtain, you can wind the coils on ¼" plastic tubing or rod material. However, you would then have to attach a 50 pF variable capacitor in series with the 15 pF capacitors that are located across each coil. Be aware that tuning may be more critical with this method and the Q of the tuned circuit may suffer. L2 and L3 should be mounted side-to-side about ¾" apart for best coupling. If switch S1 is hard to find, you can use a DPDT and a SPST (or SPDT) switch instead of the 3PDT switch that reroutes the FIRE-BALL output. Use the

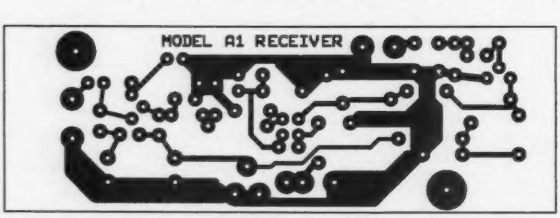

MODEL A1 RECEIVER

*Figure 2. PC board foil pattern.*

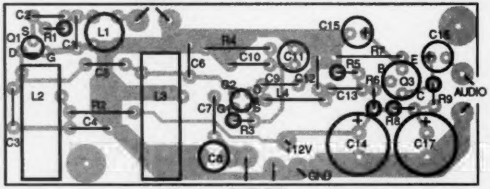

ANT
C2
S
R1
Q1
D
G
C1
L1
C15
C16
R4
R7
C10
C11
R5
E
C6
C9
C12
R6
Q3
B
C
R9
AUDIO
C5
L2
L3
R2
Q2
L4
C13
R8
C7
G
S
D
R3
C4
C14
C17
C3
12V
C8
GND
INJEC TION

*Figure 3. Parts placement.*

DPDT switch to route the FIRE-BALL output to the receive mixer and change the antenna to the receive input. The SPDT (or SPST) switch then just turns on the FIRE-BALL (or you can just hold down your CW key).

## Tune Up and Operation

To tune up the Smoke Detector receiver just peak up L1, L2 and L3 for the strongest received signal. Then adjust variable capacitor C1 for the best sound (too high of an injection level will distort the signal). Now all that's required for complete transceive operation is to flip just one (or two) switches. That's all there is to it. You're now ready for some real DX fun with one of the world's smallest transceivers!

---

*You can contact Martin Beck WB0ESV at 1637 Hood, Wichita KS 67203.*

### Parts List.

| | |
|---|---|
| 1 | MPF102 FET, RS#276-2062 |
| 1 | 40673 FET, Circuit Specialists or JAMECO |
| 1 | 2N2222 transistor, RS#276-2009 |
| 2 | 100k ¼ watt resistor |
| 1 | 10k ¼ watt resistor |
| 1 | 4.7k ¼ watt resistor |
| 1 | 470 Ω ¼ watt resistor |
| 2 | 270 Ω ¼ watt resistor |
| 2 | 100 Ω ¼ watt resistor |
| R1 | 51 Ω ¼ watt resistor, Mouser 29SJ500-51 |
| 2 | 10 µF electrolytic capacitor |
| 1 | 0.1 µF ceramic disc capacitor |
| 1 | 0.01 µF ceramic disc capacitor |
| 2 | 0.005 µF ceramic disc capacitor |
| 3 | 470 pF ceramic disc capacitor |
| 1 | 120 pF ceramic disc capacitor |
| 4 | 15 pF ceramic disc capacitor |
| C1 | 6–50 pF variable capacitor, RS#272-1340 |
| S1 | 3PDT switch, Mouser# 10TC280 (a DPDT and SPST can be substituted) |
| 1 | 1 mH choke, Mouser# 43LH210 or ME434-1250 (also Circuit Specialists# 70F103AI |
| L1, L2, L3 | 17 turns #26 enameled-covered magnet wire close wound on J.W. Miller slug tuned ¼" core (red slug)<br>James Millen coil form #69057 can be used as well |
| 1 roll | #26 guage magnet wire, RS#278-1345 |

A blank PC board is available for $3 + $1.50 postage from FAR Circuits, 18N640 Field Court, Dundee, IL 60118.

Supplier addresses:
Mouser Electronics
P.O. Box 699
Mansfield, TX 76063
(800) 346-6873

Circuit Specialists, Inc.
P.O. Box 3047
Scottsdale, AZ 85271-3047
(800) 528-1417

JAMECO Electronics
1355 Shoreway Road
Belmont, CA 94002
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|---|---|---|
| 100MS/s (25MS/s on 4 channels simultaneously), 100MHz, 4kw x 1ch., 2kw x 2ch., 1kw x 4ch. | VC-6145 | $ 4,695.00 |
| Compact, Full Feature Models | | |
| 40MS/s, 100MHz, 4kw x 1ch., 2kw x 2ch. | VC-6045 | $ 3,049.00 |
| 20MS/s, 50MHz, 2kw x 2ch. | VC-6025 | $ 2,295.00 |
| Low Cost/High Value Models | | |
| 20MS/s, 50MHz, 2kw x 2ch. | VC-6024 | $ 2,049.00 |
| 20MS/s, 20MHz, 2kw x 2ch. | VC-6023 | $ 1,749.00 |

RSOs from Hitachi feature such functions as roll mode, averaging, save memory, smoothing, interpolation, pretriggering, cursor measurements, plotter interface, and RS-232C interface. With the comfort of analog and the power of digital.

V-212 $435 DC to 20MHz Dual Channel
V-422 40MHz Dual Trace $795

Hitachi Portable Scopes
DC to 50MHz, 2-Channel, DC offset function, Alternate magnifier function
V-525 CRT Readout, Cursor Meas. $1,025
V-523 Delayed Sweep $995
V-522 Basic Mode $895

Compact Series Scopes
Delayed Sweep
Lightweight (13lbs)
2mV Sens
3 Yr Warranty
Model V-1085 Shown
This series provides many new functions such as CRT Readout, Cursor measurements (V-1085/1065/665), Frequency Ctr (V-1085), Sweeptime Autoranging and Trigger Lock using a 6-inch CRT. You don't feel the compactness in terms of performance and operation.

| | | |
|---|---|---|
| V-660 | 60MHz Dual Trace | $1,195 |
| V-665 | 60MHz Dual Trace w/Cursor | $1,345 |
| V-1060 | 100MHz Dual Trace | $1,425 |
| V-1065 | 100MHz Dual Trace w/Cursor | $1,695 |
| V-1085 | 100MHz Quad Trace w/Cursor | $2,045 |
| V-1100A | 100MHz Quad Trace w/Cursor | $2,295 |
| V-1150 | 150MHz Quad Trace w/Cursor | $2,775 |

20MHz Elenco Oscilloscope $375 MO-1251
- Dual Trace
- Component Tester
- 6" CRT
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- TV Sync
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# One-Tube QRP Transmitter

## *A new use for old tubes.*

by M. D. Allen

Normal people build something when they need something that they can't buy. Other people, like me, start a construction project for different reasons. I buy electronic parts that interest me, then try to think of something to build with them.

This one-tube transmitter project got its start when a tube sale flyer arrived from the Antique Electronic Supply Company. A 70L7 tube was on sale. It looked interesting, so I bought 10.

The 70L7 is a dual-purpose tube. One bottle houses a diode and a beam-power tetrode. With this combination it is possible to build a crystal-controlled oscillator and power supply without using even one semiconductor. The diode section of the 70L7 and a 47 µF capacitor make up the power supply for the transmitter. The tetrode section is wired as a crystal-controlled oscillator.

The circuit was kept as simple as possible. No frequency multiplying tricks were used. The oscillator will only operate at the crystal fundamental frequency.

I used 1/16" double-sided PC board for the component board and front panel. This stuff is easy to work with and provides a good ground and good shielding. I cut out the top of a tin cookie box lid, leaving a ¼" lip, then soldered the component board to this lip, replacing the cut-out section. The front panel was soldered to the component board and to the remaining section of the lid. Screwing the component board to the open side of a chassis box, if you have one, would be less work than modifying a cookie tin.

### Circuit Description

The earth ground of the power cable (green wire) is connected to the chassis. Key jack J1 is the type that closes the circuit when the plug is removed, enabling the transmitter when the key is unplugged, and permitting the operator to tune up or troubleshoot without holding the key down.

Resistor R3 provides cathode self-bias and resistor R1 drops the screen voltage, limiting the plate current to a safe value (approximately 50 mA) when the oscillator is not running. A plate current of 50 mA is only 10 mA greater than the 70L7's "Class A" rating, so the tube will not go up in flames during tune-up. Do not leave the tube in this condition for more than a few minutes at a time, because 50 mA on the plate does exceed its rating. Resistor R2 provides a DC return for the control grid. Capacitors C1 and C2 bypass RF to chassis ground. Without these capacitors RF would appear at tube pins 4 and 6, lowering the gain of the tube and preventing oscillation. The values of C2, C3, and R3 will affect the keying characteristics of the transmitter.

Switch S2 shunts the plate milliamp meter during transmission. Shunting the meter will prevent it from being beat up during keying. The tank circuit has a shunt feed using RF choke RFC1 and capacitor C5. This keeps the DC plate voltage off the tuning capacitor and the tank coil L1.

I wound the tank coil L1 on a 1.25" diameter plug-in coil form. A cardboard tube from a roll of T-paper will work just as well if it is dipped in shellac or varnish. A T-paper roll is 1.5" in diameter, so fewer turns of wire are required. The L1 winding of the coil consists of 18 turns of #24 solid enameled wire, spaced over 1.25". The output link L2 has 2.5 turns of #24 insulated hook-up wire wound over the ground (cold) end of L1.

If you want a pi output, add a 3- or 4-gang capacitor to the circuit, as shown in Figure 2. The 70L7 requires 70 volts at 150 mA to light the filaments. The 10 watt 300 ohm resistor R4 drops the line voltage from 115V to the 70V required by the tube filaments. The 365 pF tuning capacitor C6 was salvaged from an old tube radio.

Only one section of the tuning capacitor is used. The larger section will be the closest to 365 pF. With the coil and tuning capacitor specified, the tuning range will be approximately 3 MHz to 10 MHz. Feel free to substi-

*Continued on page 29*

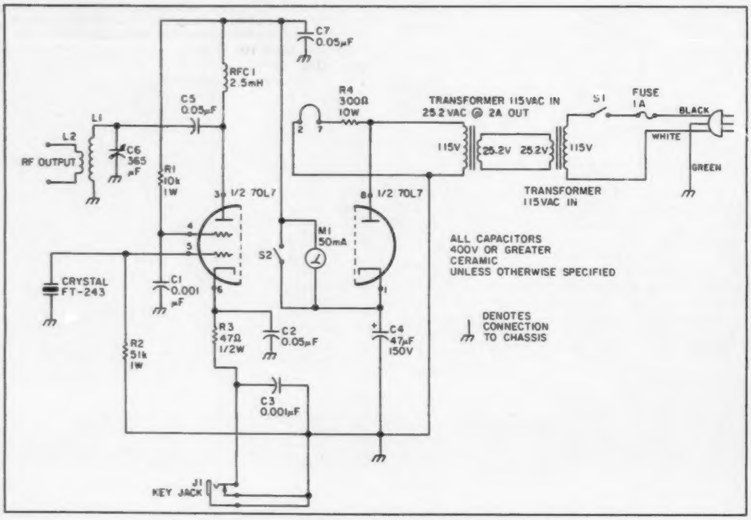

*Figure 1. QRP Transmitter with link output.*

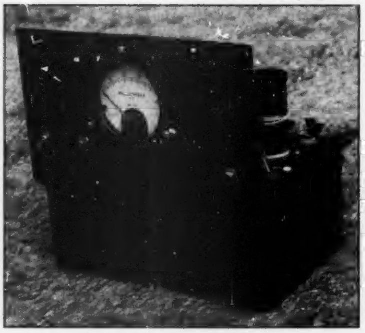

*Photo A. Front panel view.*

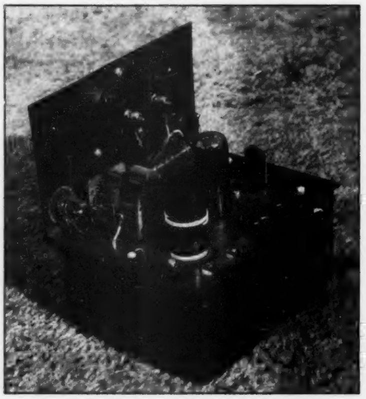

*Photo B. Internal view of transmitter.*

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*Frequency range: 29-54, 118-174, 406-512, 806-956 MHz. Excludes 823.9875-849.0125 and 868.9875-894.0125 MHz.*

The *Bearcat* 760XLT has 100 programmable channels organized as five channel banks for easy use, and 12 bands of coverage including the 800 MHz. band. The *Bearcat* 760XLT mounts neatly under the dash and connects directly to fuse block or battery. The unit also has an AC adaptor, flip down stand and telescopic antenna for desk top use. 6-5/16" W x 1⅝" H x 7⅜" D. Model **BC 590XLT-A1** is a similar version without the 800 MHz. band for a new low price of only $194.95. Order today.

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List price $587.50/**CE price $299.95/SPECIAL**

***16 Channel • 25 Watt Transceiver • Priority***

The *RELM* RH256B is a sixteen-channel VHF land mobile transceiver designed to cover any frequency between 150 to 162 MHz. Since this radio is synthesized, no expensive crystals are needed to store up to 16 frequencies without battery backup. All radios come with CTCSS tone and scanning capabilities. A monitor and night/day switch is also standard. This transceiver even has a priority function. The RH256 makes an ideal radio for any police or fire department volunteer because of its low cost and high performance. A *60 Watt* VHF 150-162 MHz. version called the **RH606B-A** is available for $429.95. A UHF 15 watt, 16 channel version of this radio called the **RU156B-A** is also available and covers 450-482 MHz. but the cost is $454.95.

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| **PRO330E-A** *Uniden* 40 Ch. Remote mount CB | $104.95 |
| **ER100-A** *Uniden* Emergency CB Mobile | $49.95 |
| **GRANT-A** *Uniden* 40 channel SSB CB mobile | $166.95 |
| **PC122-A** *Uniden* 40 channel SSB CB mobile | $119.95 |
| **PRO510XL-A** *Uniden* 40 channel CB Mobile | $38.95 |
| **PRO510AXL-A** *Uniden* CB Mobile with antenna | $49.95 |
| **PRO520XL-A** *Uniden* 40 channel CB Mobile | $56.95 |
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### ★★★*Uniden Radar Detectors*★★★

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| | |
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| **RD3XL-A** *Uniden* 3 band radar detector | $159.95 |
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| **RD99GT-A** *Uniden* remote mount radar detector | $119.95 |
| **CARD-A1** Uniden credit card size radar detector | $159.95 |

## Bearcat® 200XLT-A

List price $509.95/**CE price $239.95/SPECIAL**

***12-Band, 200 Channel • 800 MHz. Handheld***
***Search • Limit • Hold • Priority • Lockout***

*Frequency range: 29-54, 118-174, 406-512, 806-956 MHz. Excludes 823.9875-849.0125 and 868.9875-894.0125 MHz.*

The *Bearcat* 200XLT sets a new standard for handheld scanners in performance and dependability. This full featured unit has 200 programmable channels with 10 scanning banks and 12 band coverage. If you want a very similar model without the 800 MHz. band and 100 channels, order the **BC 100XLT-A** for only $189.95. Includes antenna, carrying case with belt loop, ni-cad battery pack, AC adapter and earphone. Order your scanner now.

## Bearcat® 800XLT-A

List price $549.95/**CE price $239.95/SPECIAL**

***12-Band, 40 Channel • No-crystal scanner***
***Priority control • Search/Scan • AC/DC***

*Bands: 29-54, 118-174, 406-512, 806-912 MHz.*

***New...nothing excluded in the 806-912 MHz. band.***

The Uniden 800XLT receives 40 channels in two banks. Scans 15 channels per second. Size 9¼" x 4½" x 12½." With nothing excluded in the 806-912 MHz. band, this scanner is an excellent choice for law enforcement agencies. If you do not need the 800 MHz. band, a similar model called the **BC 210XLT-A** is available for $178.95.

## *NEW!* Bearcat® 147XL-A

List price $189.95/**CE price $94.95/SPECIAL**

***10-Band, 16 Channel • No-crystal scanner***
***Priority control • Weather search • AC/DC***

*Bands: 29-54, 136-174, 406-512 MHz.*

The *Bearcat* 147XL is a 16 channel, programmable scanner covering ten frequency bands. The unit features a built-in delay function that adds a three second delay on all channels to prevent missed transmissions. A mobile version called the **BC560XLT-A** featuring priority, weather search, channel lockout and more is available for $94.95. CEI's package price includes mobile mounting bracket and mobile power cord.

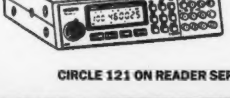
## *NEW!* Ranger® RCI2950-A

List price $549.95/**CE price $249.95/SPECIAL**

***10 Meter Mobile Transceiver • Digital VFO***
***Full Band Coverage • All-Mode Operation***
***Backlit liquid crystal display • Auto Squelch***
***RIT • 10 Programmable Memory Positions***

*Frequency Coverage: 28.0000 MHz. to 29.6999 MHz.*

The *Ranger* RCI2950 Mobile 10 Meter Transceiver by Ranger, has everything you need for amateur radio communications. The RF Power control feature in the RCI2950 allows you to adjust the RF output power continuously from 1 watt through a full 25 watts output on USB, LSB and CW modes. The RCI2950 also features a noise blanker, roger beep, PA mode and more. The Mic Gain Control adjusts the gain in transmit and PA modes to maximize talk power. Digital VFO. Built-in S/RF/MOD/SWR meter. Frequency selections may be made from a switch on the microphone or the front panel. There is even a repeater split switch for repeater offsets. The RCI2950 lets you operate AM, FM, USB, LSB or CW for full mode operation. The digitally synthesized frequency control gives you maximum stability. There's also RIT (Receiver Incremental Tuning) to give you perfectly tuned signals. With memory channel scanning, you can scan ten pre set frequencies to keep track of all the action. An optional CTCSS tone board is available (order # **RTONE**) for $59.95. For technical questions, call Ranger at 714-858-4419. Order your Ranger RCI2950 from CEI today.



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### *OTHER RADIOS AND ACCESSORIES*

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| **BC55XLT-A** *Bearcat* 10 channel scanner | $114.95 |
| **AD100-A** Plug in wall charger for BC55XLT | $14.95 |
| **PS001-A** Cigarette lighter cable for BC55XLT | $14.95 |
| **VC001-A** Carrying case for BC55XLT | $14.95 |
| **BC70XLT-A** *Bearcat* 20 channel scanner | $159.95 |
| **BC172XL-A** *Bearcat* 20 channel scanner | $134.95 |
| **BC1-A1** *Bearcat* Information scanner with CB | $119.95 |
| **BC310A-A** *Bearcat* Information Radio | $79.95 |
| **BC330A-A** *Bearcat* Information Radio | $104.95 |
| **UC102-A** *Regency* VHF 2 ch. 1 Watt transceiver | $114.95 |
| **UC202-A** *Regency* VHF 2 ch. 2 Watt transceiver | $149.95 |
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| **USAMM-A** Mag mount VHF ant. w/ 12' cable | $39.95 |
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*Continued from page 26*

**Pin Numbers for Substitute Tubes**

| **Tube Number** | **70L7**<br>**117L7** | **117M7**<br>**117N7** | **117P7** |
|---|---|---|---|
| Cathode Diode | 1 | 1 | 8 |
| Heater | 2 | 2 | 2 |
| Plate Tetrode | 3 | 3 | 3 |
| Grid 2 | 4 | 5 | 5 |
| Grid 1 | 5 | 4 | 4 |
| Cathode Tetrode | 6 | 8 | 6 |
| Heater | 7 | 7 | 7 |
| Plate Diode | 8 | 6 | * |

Pin changes if substitute tubes are used in the rig. When using the 117 series of tubes, please note that the 300 ohm resistor R4 should be removed.

*The diode plate is internally connected to the heater pin 7 for the 117P7 and 117N7.

**Parts List**

| | | |
|---|---|---|
| R1 | 10k | 1W resistor |
| R2 | 51k | 1W resistor |
| R3 | 47 ohm | ½W resistor |
| R4 | 300 ohm | 10W resistor |
| C1,3 | 0.001 µF | ceramic capacitor |
| C2,5,7 | 0.05 µF | ceramic capacitor |
| C4 | 47 µF/150 volt | electroylic capacitor |
| C6 | 365 pF | variable capacitor<br>Antique Electronic Supply #CV-230<br>or Radiokit #BC-01 |
| RFC1 | 2.5 mH | RF choke |
| Y1 | FT-243 | crystal |
| J1 | Key Jack | |
| L1 | 18 turns | #24 enameled wire |
| L2 | 2.5 turns | insulated wire around cold end of L1 |
| Tube | 70L7 (117M7, 117L7, 117P7 and 117N7 can be substituted) | |
| M1 | 50 mA | panel meter |
| T1,2 | Two 25.2V transformers connected together as an isolation transformer.<br>Any pair of the Radio Shack heavy duty power transformers can be used.<br>RS #273-1511, 273-1515, or 273-1512.<br>You can use a regular isolation transformer if it's available.<br>(Must handle at least 30 watts.) | |
| Misc. hardware | | |

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The Electronic Goldmine, PO Box 5408, Scottsdale AZ 85261. (602) 451-7454. Miscellaneous parts, resistors, capacitors, copper clad board.

JAN Crystals, 2341 Crystal Drive, Box 06017, Fort Myers FL 33906-6017. (800) 526-9825.

Antique Electronic Supply, PO Box 1810, Tempe AZ 85281. (602) 820-5411. Tubes, tube sockets, tuning capacitors, coil forms.

Radiokit, P.O. Box 973, Pelham, NH 03076. (603) 437-2722.

tute parts—only the value of R4 should not be changed.

### The Transmitter

To check out the transmitter, plug in the coil, crystal, and tube. Open S2 so that the meter will read plate current. Set C6 to maximum capacity. Do this check out with no load connected to the transmitter. Next, turn on the transmitter. After a few seconds the tube cathodes will begin to glow and the plate meter will climb to approximately 50 mA. Rotate the tuning capacitor C6 toward minimum capacitance. When C6 and L1 reach the resonant frequency of the crystal, the plate current will take a sudden dip to 15-20 mA. The oscillator should now be running, but if the actions described above do not occur, try another crystal or tube. If all else fails, check the wiring. You can confirm power output by connecting a type 47 pilot lamp to L2. The lamp will light when the oscillator is running.

The transmitter will put out maximum power when C6 is adjusted for maximum dip in the plate current. At this point the transmitter is on the hairy edge of going out of oscillation, so continue rotating C6 toward minimum capacitance until the plate current increases 2 or 3 mA above the dip current. This will assure that the transmitter will key correctly. Properly loaded into a dummy load or antenna, the plate meter should indicate 30 to 40 mA.

Consult the ARRL handbook for details on antennas. A half-wave dipole connected to the transmitter with a length of RG-59 should work well with the loop coupling. Experiment with the number of turns on the coupling loop (L2) to get the most power to the antenna. If you've used a random length of wire for an antenna, use the pi output. The transmitter should put out between 1 and 1.5 watts. QRP frequencies that can be used with this rig are 3.560 and 7.040 MHz. 10 MHz operation is also possible.

### Which Tube Pin is Which?

It has occurred to me that there may be someone out there who has never built anything with tubes. How do you determine which tube pin is which? The 70L7 has an octal base, which means that it has 8 pins and a large nonmetallic locating pin in the center of the base.

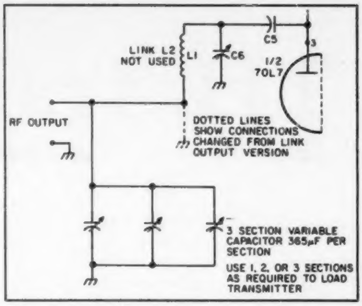

*Figure 2. QRP transmitter modified for pi output.*

Hold the tube with the base up. Locate the indexing ridge on the center pin. Counting clockwise from the indexing ridge, the first pin is #1. All of the older ARRL handbooks have tube data and base diagrams.

I still have nine more 70L7 tubes in the junk box. What next? Maybe a direct conversion or regenerative receiver? ■

---

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# TTL Transceiver for 40 Meters

## *The logical choice for QRP.*

by Rick Lucas WB0NQM

This little QRP transceiver is a lot of fun to build, and you don't have to have years of experience in electronics to build it.

Here are a few building hints:

When you use a 6V regulator the final IC must have a heat sink (See Figure 1). I used a small amount of superglue to mount the heat sink to the top of the IC to conduct away the excess heat. Remember these devices are current amplifiers. *[Ed. Note: An appropriate IC heat sink (part number 33HS016) is available from Circuit Specialists, P.O. Box 3047, Scottsdale AZ 85271-3047. Phone (800) 528-1417.]*

The 8 μH choke helps keep RF out of the power supply. I powered everything from a 12 volt battery. A 7806 regulator provides 6 volts to the TTL section. For those of you who don't like the idea of running TTL circuitry from 6 volts, just replace the 7806 with a 5 volt regulator (7805 type).

The sensitivity of this rig is somewhere around 1 μV; however, this depends a lot on your antenna. A good antenna system, such as a vertical or beam, helps the performance of the rig. Remember that this rig is a direct conversion receiver.

The selectivity of this rig is only fair. The problem is that the mixer is a pair of diodes, which makes the stage passive. If your crystal is close to a shortwave station, the commercial station may be louder than the station you are trying to receive.

The transmitter is keyed through the 8 μH choke. This helps prevent spikes.

The output of this rig using 5 VDC is approximately 250 mW;using 6 VDC, it's about 360 mW.

Tuning the output pi-network requires an SWR bridge (0–5 watt range) and a dummy load (2–100 ohm 1 W resistors in parallel). Tune coil L1 to maximum reading, then back off ¼ turn.

The crystals are fundamental frequency. Crystals in the more modern HC/6, HC/18 or HC/25 holders work better than FT-243 crystals. If ordering a new crystal it should be AT cut with 32 pF load capacitance, parallel resonant.

You can have a lot of fun with this rig. However, remember it won't compete with the high priced rigs. ■

---

*Rick Lucas WB0NQM, 412 Cattleman Ct., Lawrence KS 66049. The above material was previously published in the* SPRAT *and* Lo-Key *journals.*

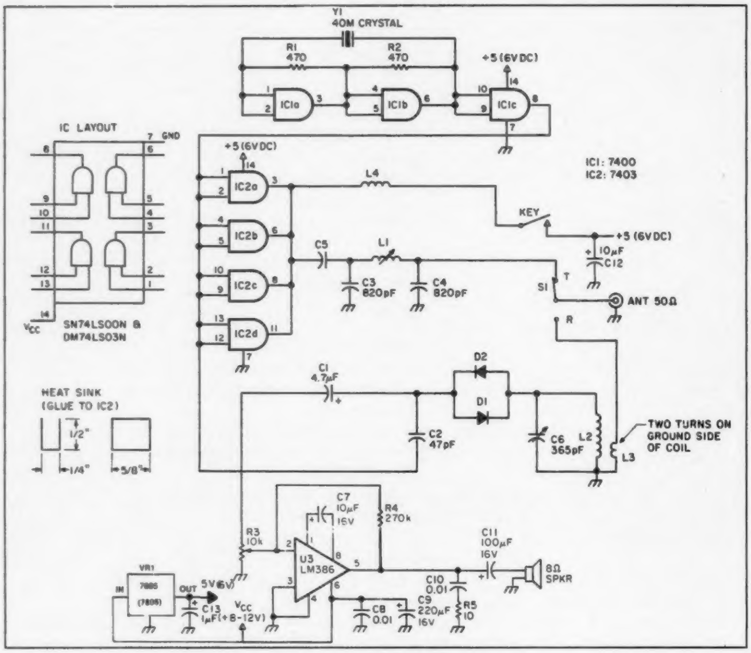

Y1
40M CRYSTAL
R1
470
R2
470
+5 (6VDC)
IC1a
IC1b
IC1c
IC LAYOUT
7 GND
Vcc
SN74LS00N &
DM74LS03N
IC1: 7400
IC2: 7403
IC2a
IC2b
IC2c
IC2d
L4
KEY
+5 (6VDC)
10μF
C12
C5
L1
C3
820pF
C4
820pF
S1
T
R
ANT 50Ω
HEAT SINK
(GLUE TO IC2)
1/2"
1/4"
5/8"
C1
4.7μF
D2
D1
C2
47pF
C6
365pF
L2
L3
TWO TURNS ON GROUND SIDE OF COIL
C7
10μF
16V
R4
270k
R3
10k
U3
LM386
C11
100μF
16V
8Ω
SPKR
VR1
IN
7806
(7805)
OUT
5V(6V)
C13
1μF
Vcc
(+8-12V)
C10
0.01
C8
0.01
C9
220μF
16V
R5
10

*Figure 1. Schematic of the TTL transceiver.*

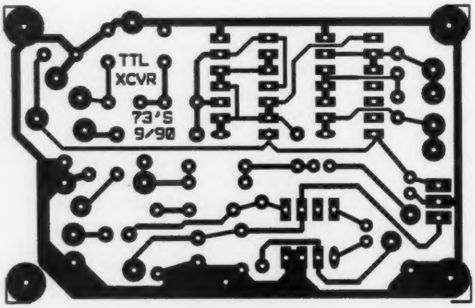
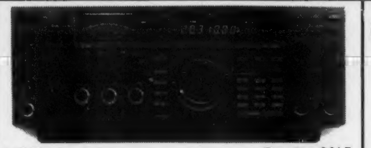

TTL
XCVR
73'S
9/90

*Figure 2. PC board foil pattern.*

Continued on page 32



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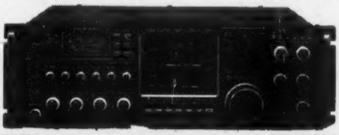

| | | |
|---|---|---|
| **IC-781** Xcvr/Rcvr/ps/tuner/scope .... | 6149 | **5199** |

| | | |
|---|---|---|
| **IC-751A** 9-band xcvr/.1-30 MHz rcvr | 1699.00 | **1469** |
| **PS-35** Internal power supply.......... | 219.00 | **199$^{95}$** |
| **FL-63A** 250 Hz CW filter (1st IF)..... | 59.00 | |
| **FL-52A** 500 Hz CW filter (2nd IF).... | 115.00 | **109$^{95}$** |
| **FL-53A** 250 Hz CW filter (2nd IF).... | 115.00 | **109$^{95}$** |
| **FL-70** 2.8 kHz wide SSB filter........ | 59.00 | |

| | | |
|---|---|---|
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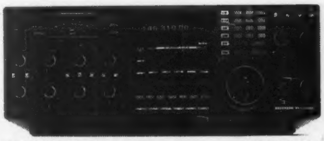

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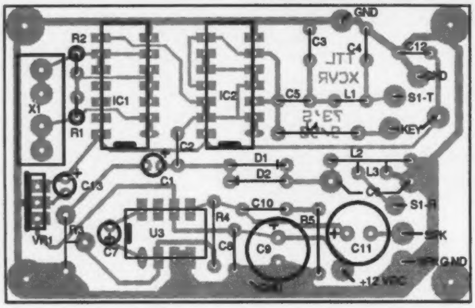

*Figure 3. Parts placement.*

### Parts List

| | | | |
|---|---|---|---|
| R1,2 | 470 ohms | ½W | |
| R3 | 10k ohm | pot | |
| R4 | 270k ohm | ¼W | |
| R5 | 10 ohm | ¼W | |
| C1 | 4.7 µF | 16V | |
| C2 | 47 pF | NPO | |
| C3,4 | 820 pF (1600 pF for 80 M) | NPO | |
| C5 | 0.01 µF | | |
| C6 | 365 pF | variable | |
| C7 | 10 µF | 16V electrolytic | |
| C8 | 0.01 µF | ceramic | |
| C9 | 220 µF | 16V electrolytic | |
| C10 | 0.01 µF | ceramic | |
| C11 | 100 µF | 16V electrolytic | |
| C12 | 10µF | tantalum | RS# 272-1436 |
| C13 | 1.0µF | tantalum | RS# 272-1434 |
| D1,2 | 1N914 | | |
| L1 | 1.0 µH (3.5 µH for 80 M) | variable | Miller 23A106RPC |
| | | (23A336RPC for 80 M) or equivalent. | |
| L2 | 100 µH choke | RS 273-102 | |
| L3 | two turns | around cold end of L2 | |
| L4 | 8 µH choke | or higher | |
| S1 | SPDT | miniature | |
| IC1 | 74LS00N | 4th section not used | |
| IC2 | 74LS03N | | |
| IC3 | LM386N | | |
| 1 | speaker | 8 ohm | |
| Y1 | crystal | 32 pF load, AT cut, parallel resonant | |
| Heat Sink | See Figure 2 | | |

A blank PC board is available for $3.75 +$1.50 postage from FAR Circuits, 18N640 Field Court, Dundee, IL 60018.
Note: C6 can be any transistor radio style tuning capacitor.

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#28 13 wpm Car Code
#29 13-15 wpm Speed Builder
#30 15-17 wpm Speed Builder
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# Goof-Proof Regenerative Receiver

## One-transistor receive fun.

by Richard Lucas WB0NQM

This little regenerative receiver is as goof-proof as possible. If you want a simple and extremely small portable receiver, this may be just the answer. By changing just one capacitor, this receiver can be set up to tune various segments ranging from 4.0 to about 26.5 MHz. You can receive AM, FM, SSB or CW all from a one-transistor circuit with excellent sensitivity.

### Construction

All components were mounted on perfboard. The complete receiver can be mounted in a small plastic case with a transistor radio battery to power it.

L1 consists of 25 turns of 26, 28 or 30 gauge enamel-covered wire wound on a T50-2 toroid (takes about 3 feet of wire). L1 is tapped five turns up from the ground end (25 percent of the total turns). An easy way to make this tap point is to extend an inch of wire and twist it together after winding the fifth turn. Scrape some of the enamel off of the end of the tap point and tin the wire at this point. (See Figure 2.) Continue winding the remainder of the 25 turns. This is a lot easier than trying to make a tap directly to L1 after it's been wound. L2 consists of three turns wound directly over L1 near the top end of the winding.

C1 can be any variable capacitor that has a tuning shaft with a value that at least covers 2–13 pF. I used an E.F. Johnson model 193-0004-001. C2 is mounted in parallel with C1 to determine the frequency range you desire. C2 should be a disc ceramic NPO-type capacitor to eliminate frequency drift due to temperature changes. See the table for the frequency ranges you can expect with various values of C2. I made a socket out of two pins of a single in-line IC socket (RS# 287-1975) to hold C2, which allows for easy band changing. *[Ed. note: A 365 pF variable cap can be used for C2 which allows for continuous coarse tuning.]*

If you use an 8 ohm audio transformer you can hook up a pair of headphones directly to the secondary of T1. You should have a reasonable volume level, but don't expect to have your ears blasted away! For those of you who'd like a speaker output, use a 1:1 600 ohm audio isolation transformer for T1 and hook it up to the LM386 audio amplifier circuit shown in Figure 1b.

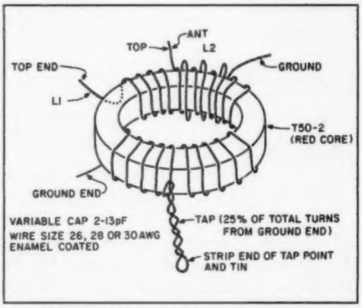
TOP
ANT
L2
TOP END
GROUND
L1
T50-2
(RED CORE)
GROUND END
VARIABLE CAP 2-13pF
WIRE SIZE 26, 28 OR 30AWG
ENAMEL COATED
TAP (25% OF TOTAL TURNS FROM GROUND END)
STRIP END OF TAP POINT AND TIN

*Figure 2. Toroid winding details.*

**Frequency Coverage Using 25-Turn Toroid**

| C2 value | Frequency Range |
|---|---|
| 500 pF | 4.0–4.1 MHz |
| 200 pF | 6.2–6.4 MHz |
| 180 pF | 6.6–6.8 MHz |
| *160 pF | 6.9–7.2 MHz (40m) |
| *150 pF | 7.2–7.4 MHz (40m) |
| 130 pF | 7.6–8.0 MHz |
| 120 pF | 7.9–8.3 MHz |
| 100 pF | 8.6–9.1 MHz |
| *82 pF | 9.4–10.0 MHz (WWV) |
| *75 pF | 9.8–10.4 MHz (30m) |
| 68 pF | 10.2–10.9 MHz |
| 56 pF | 11.0–12.0 MHz |
| 47 pF | 11.8–13.1 MHz |
| *39 pF | 12.7–14.35 MHz (20m) |
| *33 pF | 13.5–15.5 MHz (20m) |
| 30 pF | 14.0–16.2 MHz |
| 27 pF | 14.5–17.0 MHz |
| 24 pF | 15.1–18.0 MHz |
| 22 pF | 15.5–18.7 MHz |
| *20 pF | 16.0–19.6 MHz (17m) |
| 18 pF | 16.5–20.5 MHz (17m) |
| *15 pF | 17.4–22.2 MHz (17 & 15m) |
| 12 pF | 18.4–24.5 MHz (15m) |

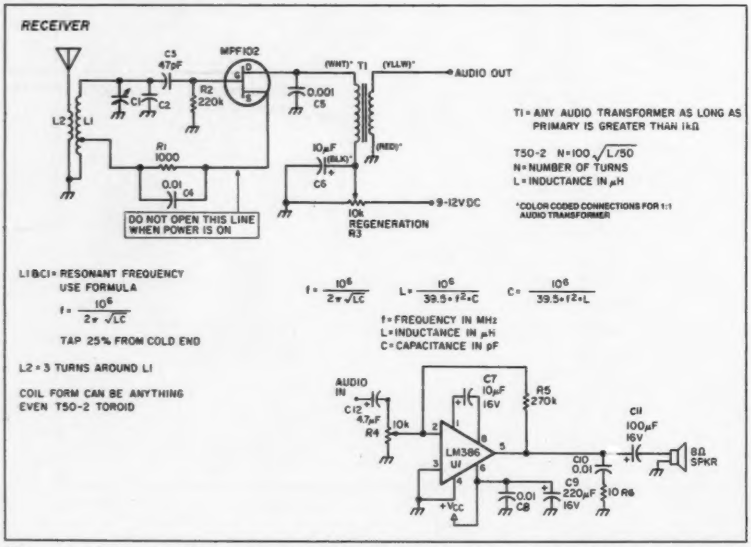
RECEIVER
C3
47pF
MPF102
G
D
S
R2
220k
C1
C2
L2
L1
(WHT)* T1 (YLLW)*
AUDIO OUT
0.001
C5
(RED)*
R1
1000
0.01
C4
10μF
(BLK)*
C6
9-12VDC
10k
REGENERATION
R3
DO NOT OPEN THIS LINE WHEN POWER IS ON
T1 = ANY AUDIO TRANSFORMER AS LONG AS PRIMARY IS GREATER THAN 1kΩ
T50-2 $N = 100\sqrt{L/50}$
N = NUMBER OF TURNS
L = INDUCTANCE IN μH
*COLOR CODED CONNECTIONS FOR 1:1 AUDIO TRANSFORMER
L1 & C1 = RESONANT FREQUENCY
USE FORMULA
$f = \frac{10^6}{2\pi\sqrt{LC}}$
TAP 25% FROM COLD END
L2 = 3 TURNS AROUND L1
COIL FORM CAN BE ANYTHING EVEN T50-2 TOROID
$f = \frac{10^6}{2\pi\sqrt{LC}}$
$L = \frac{10^6}{39.5 \cdot f^2 \cdot C}$
$C = \frac{10^6}{39.5 \cdot f^2 \cdot L}$
f = FREQUENCY IN MHz
L = INDUCTANCE IN μH
C = CAPACITANCE IN pF
AUDIO IN
C12
4.7μF
10k
R4
C7
10μF
16V
R5
270k
LM386
U1
1
2
3
4
5
6
8
+Vcc
0.01
C8
C9
220μF
16V
C10
0.01
10 R6
C11
100μF
16V
8Ω
SPKR

*Figure 1a. Schematic diagram for the goof-proof receiver. 1b. Audio amplifier stage. Use the formulas to determine the number of turns for L1 to allow expanded frequency coverage.*

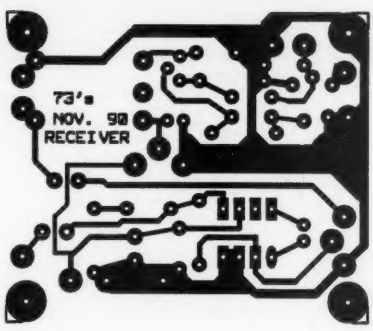

*Figure 3. PC board foil pattern.*

**Parts List**

**Receiver**

| | |
|---|---|
| Q1 | MPF102 FET |
| R1 | 1k ¼ watt resistor |
| R2 | 220k ¼ watt resistor |
| R3 | 10k potentiometer |
| C1 | 1.4–13 pF variable capacitor (E.F. Johnson #193-0004-001) |
| *C2 | Ceramic disc capacitor type NPO (See table for values) |
| C3 | 47 pF ceramic disc capacitor |
| C4 | 0.01 µF ceramic disc capacitor |
| C5 | 0.001 µF ceramic disc capacitor |
| C6 | 10 µF electrolytic capacitor |
| 1 | T50-2 toroid core |
| L1 | 25 turns #26, 28 or 30 gauge enamel-covered magnet wire on T50-2 toroid, tapped 5 turns from ground end |
| L2 | 3 turns #26, 28 or 30 guage enamel-covered magnet wire over top end of L1 |
| T1 | 1000 ohm:8 ohm audio output transformer (for headphone use): RS# 273-1380 or<br>1:1 600 ohm audio isolation transformer (for use with audio amplifier circuit) RS# 273-1374 |
| 1 | pair of headphones RS#33-1000 (not needed if audio amplifier circuit is used) |
| 1 | roll, enamel-covered magnet wire (26–30 guage OK) RS#278-1345 |

**Optional Audio Amplifier**

| | |
|---|---|
| U1 | LM386 audio amplifier IC |
| R4 | 10k potentiometer |
| R5 | 270k ¼ watt resistor |
| R6 | 10 Ω ¼ watt resistor |
| C7 | 10 µF/16V electrolytic capacitor |
| C8 | 0.01 µF ceramic disc capacitor |
| C9 | 220 µF/16V electrolytic capacitor |
| C10 | 0.01 µF ceramic disc capacitor |
| C11 | 100 µF/16V electrolytic capacitor |
| C12 | 4.7 µF/16V electrolytic capacitor |
| SPKR | 8 ohm speaker |

The T50-2 toroid core as well as a selection of variable tuning capacitors are available from Radiokit, P.O. Box 973, Pelham NH 03076; Phone: (603) 437-2722.

A blank PC board is available for $3.50 plus $1.50 postage from FAR Circuits, 18N640 Field Court, Dundee IL 60118

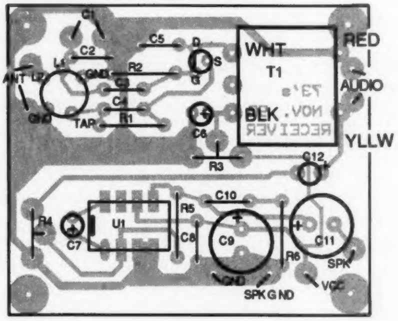

*Figure 4. Parts placement (color coded leads for T1 indicated if using the 1:1 audio isolation transformer).*

## Operation

Plug in capacitor C2 for the band segment you wish to tune. For AM or FM reception, adjust the regeneration control R3 until you hear a hissing sound. Then, back it off until the noise just stops. For SSB or CW reception, adjust the tuning capacitor C1 until you hear a station. Turn the regeneration control until the hissing just starts and adjust it for the best sounding SSB or CW reception. This rig is quite sensitive but don't expect the selectivity to equal your big transceiver. However, it sure is a lot more portable!

*Contact Rick Lucas WB0NQM at 412 Cattleman Ct., Lawrence KS 66049. Article reprinted from the* Lo-Key *and* SPRAT *journals.*

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# MOuSe-FeET

## *A 40 watt QSK CW amplifier.*

by Bill Heishman N5HNN

Most of today's home-brew hams seem to be QRPers. This is what attracted me to QRP—I am, by nature, a tinkerer. Yet, on the momentous occasion of my first home-brew to home-brew contact with fellow rosin-sniffer NZ5G, conditions were marginal. We did indeed make contact with our sidewalk sale surplus, but we could not rag-chew. So began my quest for more power. Leaving the QRP fold for a solid rag-chew may seem sacrilegious to some, but to others it might spur a renewed interest in construction.

Bruce NZ5G and I tried some of the old standby amplifier circuits found in several popular reference books and old magazine articles. The experience was great, but none of the amps we tried satisfied all of our desires: at least 20 watts output; QSK and silent (no relays); simple; cheap.

Finally, I came close with a 40 watt amp using a MRF477 (not cheap). It was monoband (simple), electronically switched (QSK) and 30 to 40 watts out. It provided some solid QSOs and lots of "great sounding rig" comments. However, it overheated quickly in the small box I wanted to use and cost more than I liked. Not perfect, but I was smugly satisfied.

While I was describing (bragging about) my newest success to the local parts merchant, he interrupted my discourse to show me his newest widget. "These are MOSFETs," he said. "I hear that they amplify RF somewhat." I became real interested since the price was less than two bucks! He carefully wrapped a couple in aluminum foil and "gave" them to me, knowing that I would be back for more.

I took the parts home, read and reread the "Three Fine Mice-MOuseFET CW Transmitters" article in the December 1986 issue of *QST*, and convinced myself that with a few circuit adaptations these higher power devices would really work. Eventually they did, and worked wonderfully. It just took time, several more MOSFETs, and practical experience in breakdown voltage, not to mention 10 to 20 fuses.

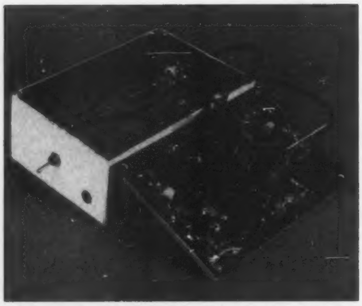

*Photo A. The 40 meter MOSFET amp (Photo by Charlie Knight WI5S).*

It was worth the trouble, because I ended up with an amplifier that met all our criteria. The amp was simple, very cheap, QSK, 30 to 40 watts out, and ran surprisingly cool with a modest heatsink.

### Design

At this point most articles begin the complicated math and calculations used to design their circuits. However, most hams do not build this way. The design covered in this article was "hacked out" using a combination of starting values guesstimated from a reference article and practical experience.

Simply start with something close, experiment, then adjust the values. Construct this amp to go with your HW-9 and start your experience growing.

### Circuit Operation

Let's ramble through the amp now and see how it works. The receive path through the amp is via the 6.8 μH choke in series with a 10–100 pF variable capacitor, tuned to resonance. D7 and D8 will decouple this circuit when the amp is transmitting, since the diodes act as open switches with very small voltages (receiving) and closed switches with large voltages (transmitting).

The transition from receive to transmit occurs when D5 and D6 sample RF from an exciter. The resulting negative potential forward biases the 2N3906 that delivers 14 volts to a 270 ohm resistor. This becomes voltage source "A," which is then fed through L7 and L5 to forward bias the "common" power diodes, D3 and D4, serving as PIN diode switches. At this moment, the transmitter is coupled to the input matching circuit, and the output matching circuit of the amp is coupled to the antenna.

If you can be satisfied with degraded receiver performance, leave out D3 and D4 and associated switching circuitry. The amp will work, although weak signal reception will suffer.

There are a few parts not covered yet. The 150 and 1500 ohm resistors provide needed stability. D1 rectifies some of the drive to provide forward bias and limits dangerous voltage excursions. R5 limits the current through D1. D2 and R7 protect against voltage spikes at the drain. This situation can occur without D2 under unusual load conditions (i.e., high SWR). With D1/R5 and D2/R7 combinations in place, this circuit is very rugged.

### Construction

Besides traditional etching, I have used two "cheap and simple" methods to prepare the circuit board. One is to cut square

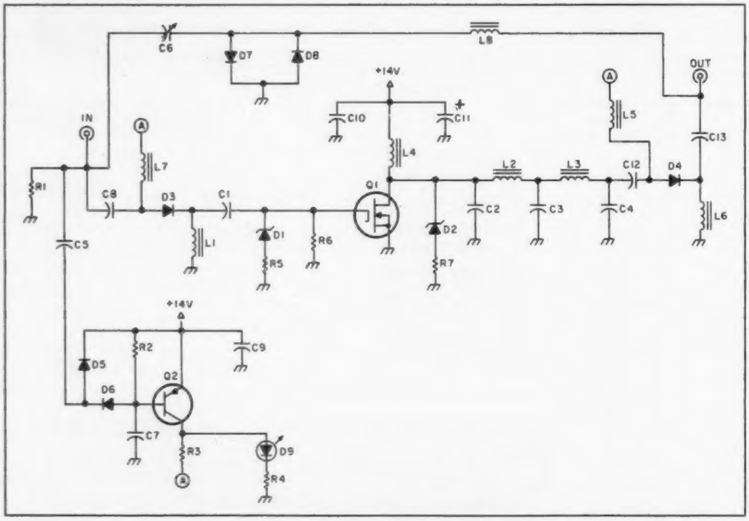

*Figure 1. Schematic diagram.*

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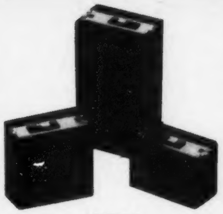

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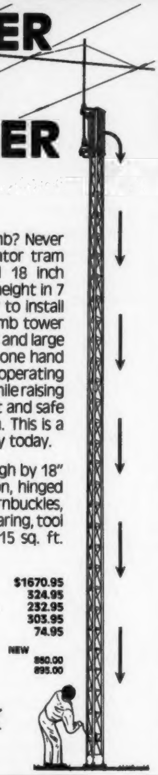

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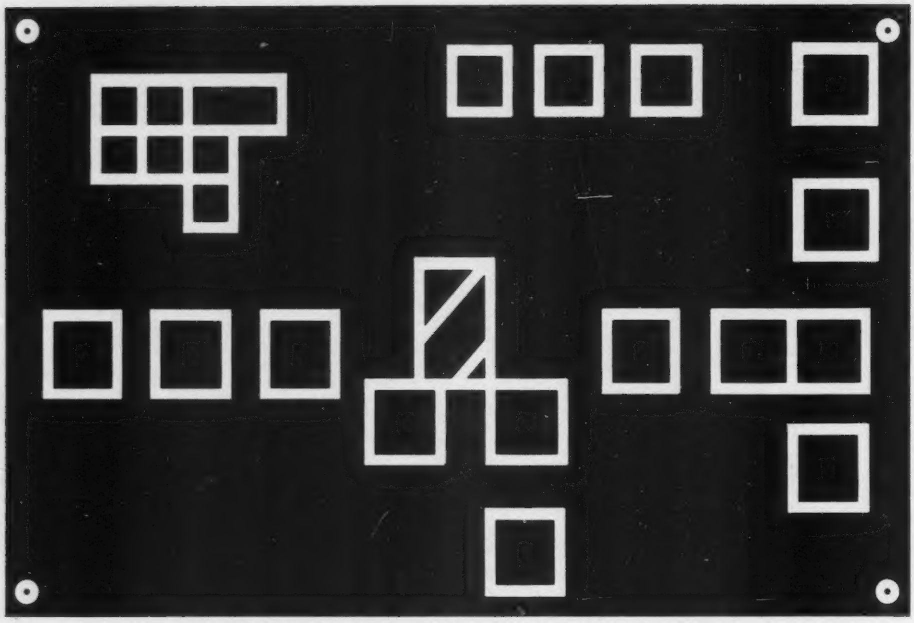

*Figure 2. PC board foil pattern. Cut out hole for Q1 in center of board.*

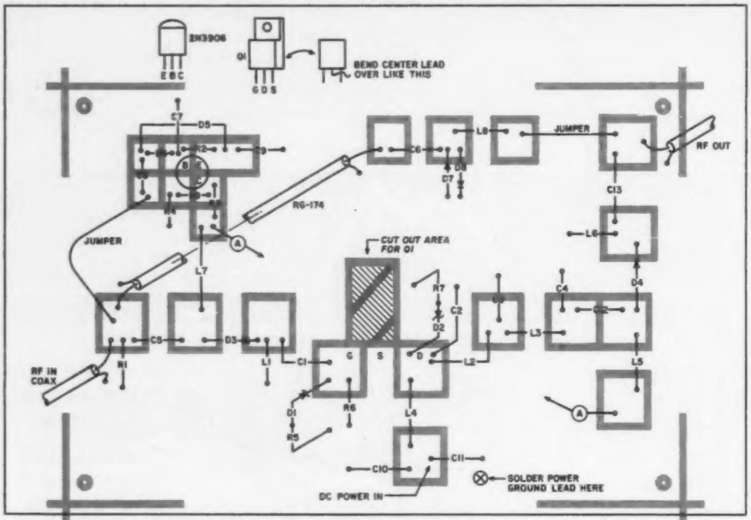

*Figure 3. Parts placement. All components mounted on foil side of PC board.*

pads from scrap printed circuit board the same size as the pads on the layout. Epoxy them to the motherboard in the approximate locations shown. For speed and less mess I use a rotary tool with a thick cut-off wheel. With a little practice it is very easy to zip ample gaps between solder pads and the surrounding ground plane. For greater accuracy, try tracing the layout onto the copper board first, using carbon paper behind a photo copy of the layout. Then you might as well outline those marks with a direct etch pen, fill in the gaps, and etch the board.

The final step is to cut the hole for mounting the MOSFET. The best way is to drill a 0.375″ starting hole and finish up with a nibbling tool. A coping saw will also do a nice job. A 0.125″ x 3.75″ x 5.75″ aluminum plate makes a "cheap and simple" heat sink. It also provides support and stability. Clamp the prepared board onto the plate and drill the four corner holes and mounting hole for the MOSFET. Secure the pieces together with 4-40 hardware at the corners. Now is a good time to tin (pre-solder) the pads and component leads. This is a good practice and speeds construction. Bending and trimming the leads of the components ahead of time is also a good practice. A little preparation will ensure speedy construction, uniform appearance, and neatness.

Use the component placement diagram to solder the parts in place, leaving the MOSFET for last. Refer to the schematic often to follow what you are doing. The LED might be mounted on the face of your enclosure. Route the jumpers as shown, laying them close to the board and out of the way. Mounting Q1 is no big deal. Just make sure everything is at the same potential (even you) with ground straps, alligator clip-leads, and/or physical contact. Once the device is mounted and soldered, it is very rugged and static-proof. The tab must be insulated from the heatsink and mounting screw with a mica insulator and matching plastic washer. You could substitute a nylon screw for the metal screw and plastic washer. Add a dab of silicone grease or heat sink compound (available at Radio Shack) to both sides of the mica insulator. Carefully bend the drain (center) lead up and over the source to reach its pad.

## Tune-Up

Tune-up is a snap. Hook the amp up to your transceiver and peak the variable cap for maximum received volume or background noise. Use about 1 watt of drive and try a couple of short dits. Your wattmeter should move and the LED should blink. If they don't, check all the pads and make sure none of them are shorted to ground. Peak the amp by tweaking the coils on the toroids. Expect to spread the turns apart on L2 somewhat and to squeeze them together on L3. Any instability can usually be cured by adjusting L1 similarly. Increase the drive to 2 watts and peak again. With a little luck, you should get about 40 watts out with a 14 volt supply. If the output crawls with temperature, check C2–C4 for heating. I have found a few silver mica caps that could not handle the RF current in this circuit. Also, if Q1 is not heat-sinked properly, output will drop as it heats up.

## Enclosure

You can build a nifty enclosure using the heat sink for the bottom. For the top, cut another piece of PCB the same size as the circuit board. I used these dimensions for the four side pieces: 2″ high x 3.75″ long minus two times the thickness of the board for the shorter ends, and 2″ high x 5.75″ long for the two longer end pieces. With square, accurate cuts these pieces are self-aligning when soldered together on the inside. Solder a 4-40 threaded stand-off into each corner. Take the mounting screws out of the corners of the amp and place the top over the board. The screws should lock the cover down over the amp. I used extra long screws and rubber feet

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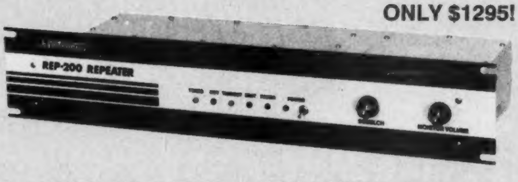

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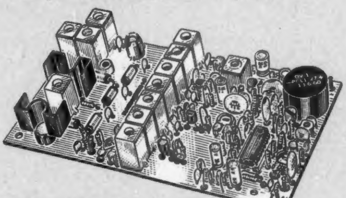

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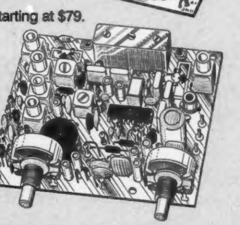

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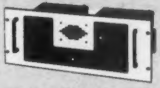

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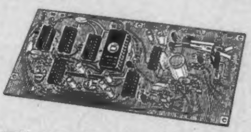

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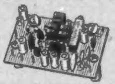

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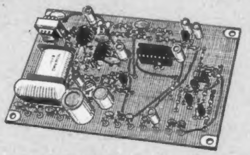
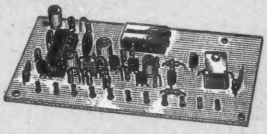


**AP-3 AUTOPATCH** kit. Use with above for repeater autopatch. Reverse patch & phone line remote control are std . $79

**AP-2 SIMPLEX AUTOPATCH** Timing Board kit. Use with above for simplex operation using a transceiver ........... $39



**MO-202 FSK DATA MODULATOR** kit. Run up to 1200 baud digital signals through any fm transmitter with full handshakes. Radio link computers, telemetry gear, etc. ............................ $39

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**Specify tuning range: 26-30, 46-56, 137-150, 150-172, 210-230, 400-470, or 800-960 MHz.*

## LNW-(*)
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## LNS-(*)

## IN-LINE PREAMP

***ONLY* $79/kit, $99 wired/tested**

- GaAs FET Preamp with features similar to LNG series, except **automatically switches out of line during transmit.** Use with base or mobile transceivers up to 25W. Tower mounting brackets incl.

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**902-928 MHz** converts down to 422-448 or 430-450 range. Same price as uhf.

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CIRCLE 332 ON READER SERVICE CARD

### Parts List (40 meter amplifier)

| | | |
|---|---|---|
| Resistors | | |
| R1 | 150 ohm | 1 watt |
| R2 | 10k ohm | ¼ watt |
| R3 | 270 ohm | ½ watt |
| R4, R6 | 1500 ohm | ¼ watt |
| R5 | 27 ohm | ½ watt |
| R7 | 330 ohm | 2 watt |
| Capacitors | | |
| C1 | 1200 pF silver mica | 100 volt |
| C2 | 1000 pF silver mica | 1000 volt |
| C3 | 1500 pF silver mica | 1000 volt |
| C4 | 750 pF silver mica | 1000 volt |
| C5 | 33 pF ceramic | |
| C6 | 10–100 pF variable trimmer | |
| C7, C8, C9, C10, C12, C13 | 0.1 uF 50 V monolithic | |
| C11 | 100 uF 25 WVDC electrolytic | |
| Inductors | | |
| L1 | 10 turns, 22 gauge enameled wire on Amidon T50-6 | |
| L2 | 7 turns, 18 gauge enameled wire on Amidon T80-2 | |
| L3 | 15 turns, 18 gauge enameled wire on Amidon T80-2 | |
| L4 | 10 turns, 18 gauge enameled wire on Amidon FT50-61 | |
| L5–L7 | 150 µH epoxy-dipped choke | |
| L8 | 6.8 µH epoxy-dipped choke | |
| Semiconductors | | |
| D1 | 15 volt ½ watt zener | |
| D2 | 28–35 volt 1 watt zener | |
| D3 | 2.5 amp 100–1000 volt PIV power diode | |
| D4 | 3.0 amp 100–1000 volt PIV power diode | |
| D5–D8 | 1N914 or equivalent switching diode | |
| D9 | common LED | |
| Q1 | IRF-531 power MOSFET | |
| Q2 | 2N3906 or equivalent PNP transistor | |

Parts Availability and Addresses

Most diodes, resistors and capacitors are common values and should be available at Radio Shack and similar outlets.

Toroid cores and Silver mica capacitors can be ordered from Circuit Specialists, Radiokit or Tanner Electronics.

The IRF-531 MOSFET is available from Digi-Key and Tanner Electronics.

A blank PC board and a partial kit consisting of the heat sink, the IRF-531 MOSFET, and the zener diode are available for $14.95 + $3 shipping and handling from Tanner Electronics.

Tanner Electronics
1301 West Beltline Rd., Suite 105
Carrollton TX 75006
(214) 242-8702

Circuit Specialists
P.O. Box 3047
Scottsdale AZ 85271-3047
(800) 528–1417

Digi-Key
701 Brooks Ave. South
P.O. Box 677
Thief River Falls MN 56701
(800) 344-4539

Radiokit
PO Box 973
Pelham NH 03076
(603) 437-2722

on mine. You can decide where to mount the SO-239s and feed the power cable through. A DPDT toggle switch makes a simple on/off-bypass switch. The circuit does not draw any idle current, so there is no need to switch the power on and off. Really motivated builders will mount the LED on the front through a 3/16" hole.

If this is your first project, be particular and do not try to substitute part numbers or values. All of the basic parts should not cost more than $25, about the price of just one high power RF final.

**A Versatile Result**

With changes in a few frequency-dependent components, this circuit should work just as well on other bands. I have tacked an experimental amp together for 10 meters with the IRF-531 MOSFET and tweaked 40 watts out of it. This means that, with the same basic circuit and identical layout, you could use this amp on any HF band (see the table for component changes). The higher frequencies will need progressively more drive, up to 5 watts on 10 meters.

Maybe a few more hams can be dragged back into home construction when they realize that solid state home-brewing no longer means a choice between low power, affordable transmitters and high power, expensive finals. There is nothing more fun than sending "...running 40 watts out with home-brew amp." ■

### Table 1. Coil and Capacitor Values for 20 and 10 Meters

| Part | *20m | **10m |
|---|---|---|
| L1 | 6 turns x ½" long | 5 turns x ⅜" long |
| L2 | 3 turns x ¼" long | 3½ turns x ¼" long |
| L3 | 9 turns x ½" long | 6 turns x ½" long |
| L4 | same as 40m | 10 turns x ½" long |
| L8 | 6.8 µH | 2.2 µH |
| C1 | 1000 pF | 330 pF |
| C2 | not used | not used |
| C3 | 1360 pF | 500 pF |
| C4 | 250 pF | not used |

*L1–L3 are 20 gauge enameled wire air wound with ⅜" diameter.

**L1–L3 are 20 gauge enameled wire air wound with ¼" diameter.

Spread or squeeze coils for final tune-up.

# The Dummy Ducky

## Inexpensive dummy load for your HT!

by Richard J. Molby DA1DB/WB7NZG

After untold hours of hard labor you have finally completed your new superpower antenna system. Now comes the the final tuning at the top of the tower. You call a ham friend and you decide to use 2 meter handies to coordinate the tuning effort. Your aching bones finally bring you to the top of the tower and you turn on your handie. What do you hear? Your poor little radio is getting blasted to bits by stations many miles away and you can't seem to find a clear channel. You start to wonder why handies don't have attenuators!

The solution is simple: Before climbing the tower replace the normal rubber ducky antenna with the dummy ducky antenna.

**Building the Dummy Ducky**

The dummy ducky will do two things: It will reduce received signal levels drastically, therefore only allowing you to hear your friend's handie from your shack; and it will reduce your effective radiated signal so you do not interfere with others on the frequency. *[Ed Note: Make sure you set your HT to the low power position since the dummy ducky is limited to ½ watt.]*

The dummy ducky is simple to build. You probably already have most of the parts: a solder-type BNC connector; a ½ watt, 50 ohm carbon resistor (a 51 ohm resistor or two 100 ohm resistors in parallel can be used as well); a ¾" length of 5/16" diameter copper tubing; a 1¼" length of ¼" diameter plastic tubing; and a 1¾" length of RG-8 outer covering.

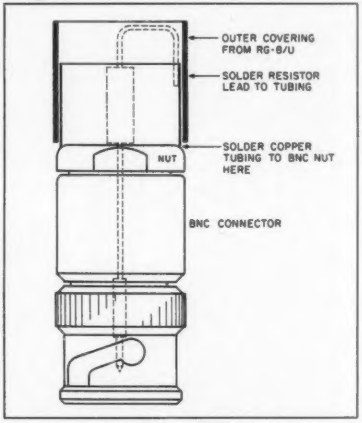
OUTER COVERING FROM RG-8/U
SOLDER RESISTOR LEAD TO TUBING
SOLDER COPPER TUBING TO BNC NUT HERE
NUT
BNC CONNECTOR

*Figure 1. The dummy ducky.*

The easiest way to start construction is to solder the length of copper tubing to the BNC connector nut, making sure it is vertical. Next, take the 50 ohm resistor and solder the BNC pin to one end. It may take some trial and error to get the correct lead length that will allow the BNC pin to be correctly positioned when the resistor is inserted into the connector body. The body of the resistor should be down into the connector as far as possible.

Next, slip the plastic tubing over the resistor and push it down into the tubing as far as possible. Then fold the resistor lead down over the edge of the tubing and trim it so that it just overlaps the edge of the copper tubing. Solder the resistor lead to the copper tubing. For the finishing touch, slide the length of RG-8 outer covering over the tubing and push it down as far as possible. To give as professional an appearance as possible, fill the top of the antenna with black liquid rubber and allow it to cure. The dummy ducky is now complete and ready to reduce those nasty interfering signals. ■

*Contact Richard J. Molby at HHSB 4BN 9th FA, APO New York 09176.*

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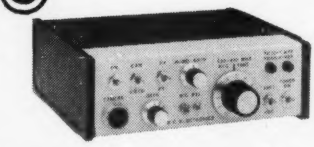

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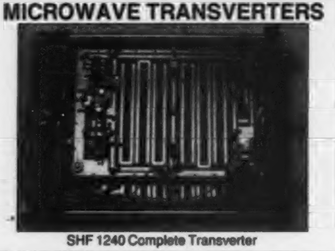
## MICROWAVE TRANSVERTERS



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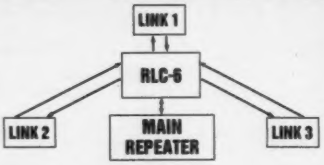

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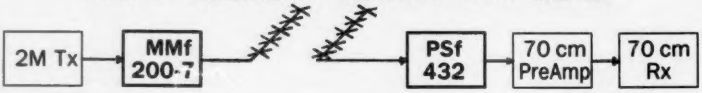

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# 73 Amateur Radio Today

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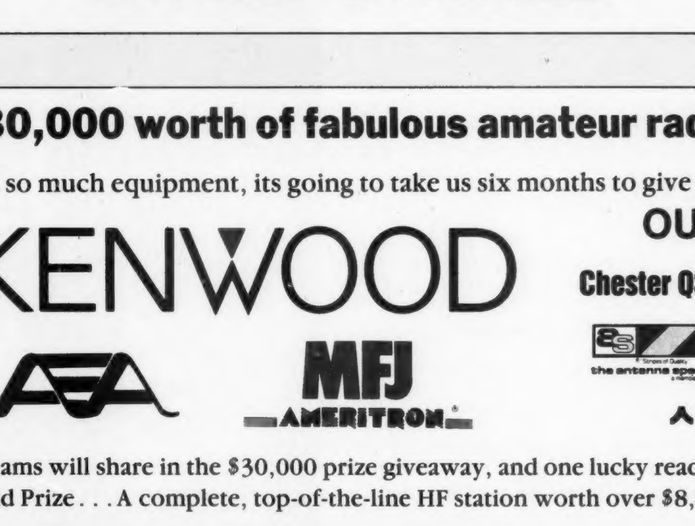

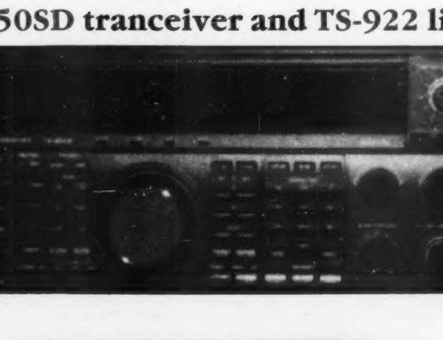

**But that's not all!**

The Grand Prize also includes Kenwood's matching speaker and desk microphone, AEA's Isoloop antenna, the 1278T 2400 baud multi-mode contoller and MultiCom software from MFJ, Ameritron's RCS-4 remote coax switch, the Bird Thruline wattmeter and an HF multi-band antenna kit from Unadilla.

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| PK-88 Packet TNC | $200 |
| Isopole VHF/UHF antennas | $100 |
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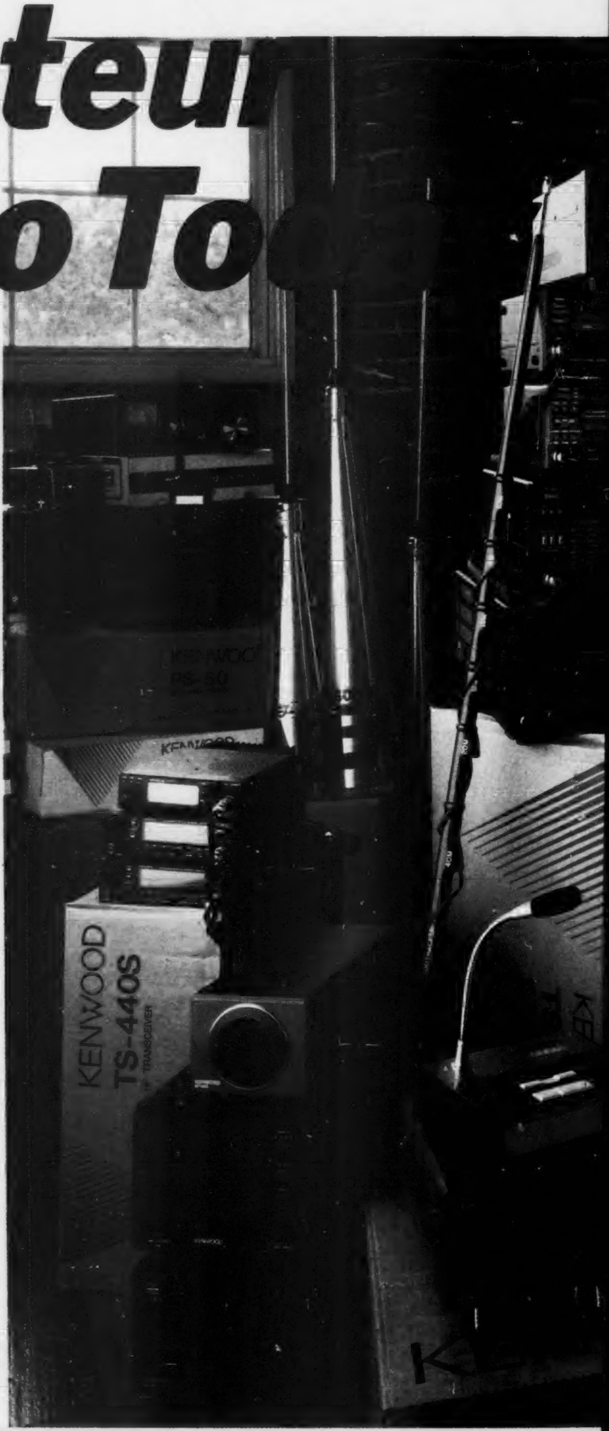
| HPF-1 high pass filter | $30 |

# 73 Amateur Radio To



## HOW TO ENTER

Visit your local participating amateur radio dealer and fill out an Official Entry Survey. Only one entry per month per person. Duplicate entries will be disqualified.

Once every month, we will pick 5 names from every participating retail outlet. * One of these lucky hams will receive that month's prize package, but all of them will be entered in the Grand Prize Drawing, to be held in April 1991.

Visit you local retailer every month to check if your name is on the Ham It Up! Tote Board, which lists all the Grand Prize entrants from that store. While you're there, fill out the next month's Official Entry Survey. Remember, you can enter once every month. You get six chances to win a fabulous prize package and six chances to be included in the Grand Prize Drawing!

After we've given away all of the monthly prize packages, we'll take the Grand Prize Drawing entries (30 from each participating retailer) and give away over $30,000 worth of great ham gear.

*If you are unable to enter at a local retailer, you may obtain an Official Entry Survey by sending an S.A.S.E. to Ham It Up! Sweepstakes, 73 Amateur Radio Today, Forest Road, Hancock, NH 03449. Return the entry survey to the same address, and you will be entered through Uncle Wayne's Bookshelf.

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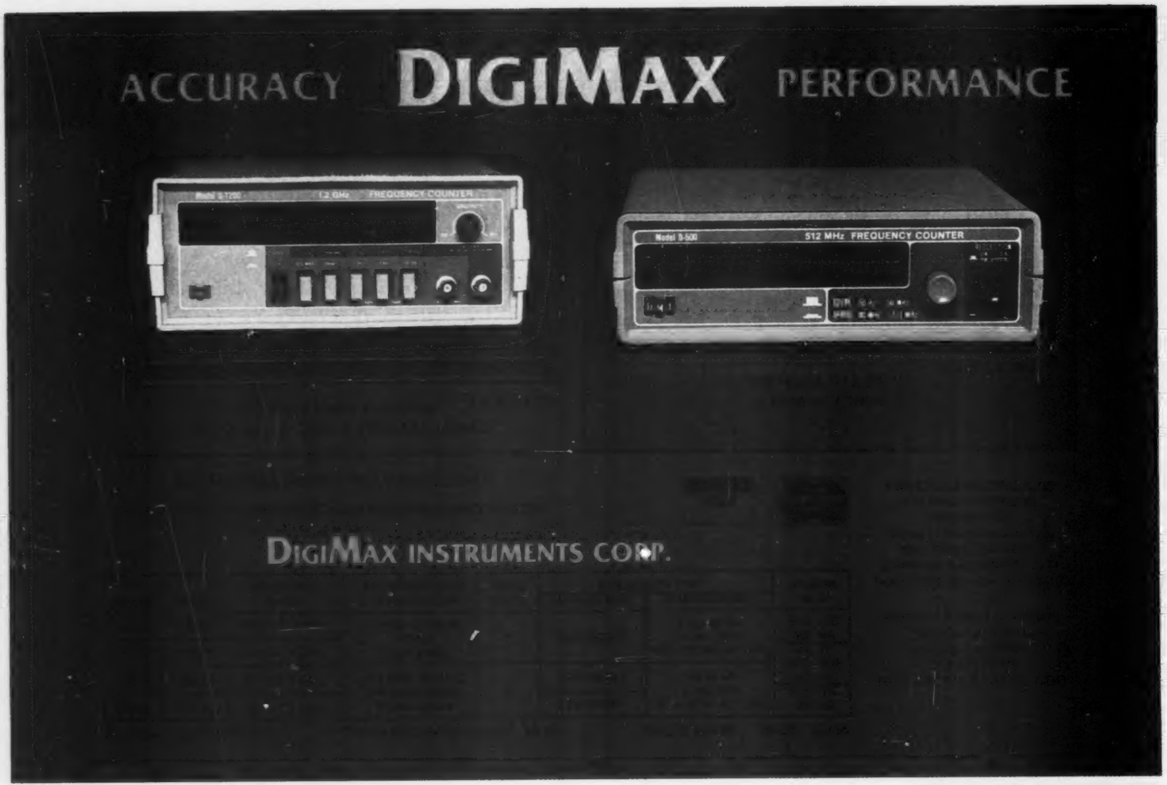
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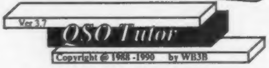

* Entry class license (Novice) requires passing a theory exam covered in this program and copying morse code at 5 words per minute. FCC application forms are available on request, free of charge. Tests are administered by local hams, call for more details.

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SGC

## SG-230

## SMARTUNER

**HF ANTENNA COUPLER—SSB, AM, CW & DATA**
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**OPERATES WITH ANY HF TRANSCEIVER**

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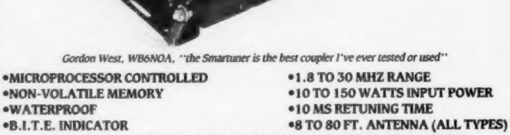

*Gordon West, WB6NOA, "the Smartuner is the best coupler I've ever tested or used"*

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CIRCLE 387 ON READER SERVICE CARD

Number 18 on your Feedback card

### 73 Review

*by Larry R. Antonuk WB9RRT*

# Heathkit Adapter and Coax Cable Kits

## *Create your own versatile adapters.*

Heath Company
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(800) 253–0570
Price Class: HCA-3001, $80; HCA-5001, $70

---

It's happened to everyone at least once. You're right in the middle of some complex (and highly important) test procedure, like measuring desense on a 2 meter repeater at the same time you're keying up a 440 repeater into a dummy load. You have one more cable to hook up, but you need a PL-259-to-N adapter. You reach into your tool box, and...hmmm. You were sure you had one more of those. Oh well, you can just screw together this BNC-to-N, along with this...no, that won't work. Let's see, maybe if I...no, not that either. It doesn't matter how many times you dump out that coffee can full of flea market RF adapters, you don't have what you need. You just "can't get there from here." The test has to be postponed (or altered, or fudged) until you get the proper equipment.

**The HCA-3001 RF Adapter Kit**

At some point, having the right tool for the job becomes important. It's either a necessity, or it's simply worth it in order to eliminate headaches. The right tool for the RF technician is now available from Heathkit.

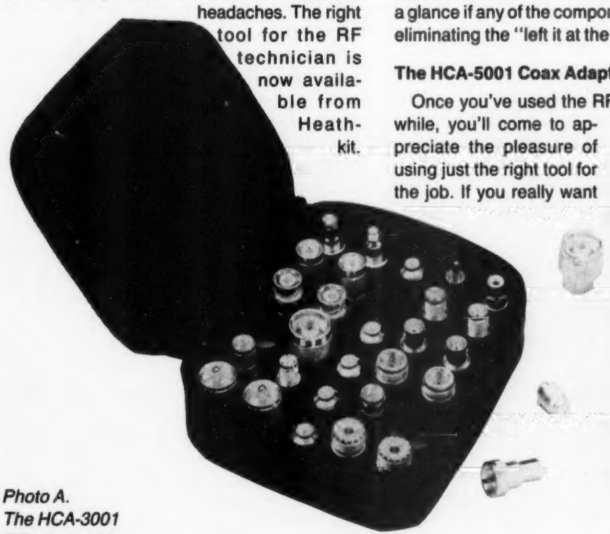

*Photo A. The HCA-3001 RF adapter kit.*

The HCA-3001 RF adapter kit is a product that should be found under every radiohead's Christmas tree. This kit consists of two dozen adapter ends and six center pieces, packed in a zippered, leather-like case. An actual adapter is made by screwing the ends (say, one female UHF and a male N) to each end of the threaded center piece. This produces an adapter that is slightly longer than the average adapter, but much more versatile. The kit contains male and female N, F, RCA, BNC, UHF, SMA, TNC, and Mini-UHF adapter ends. This means that you can get from one to another of any of these styles, making up an adapter that Amphenol never even thought of! You can now go from a female F to a female SMA in one two-inch adapter, not the seven-inch conglomeration that you have to link together now.

The adapters all have Teflon™ insulation and gold-plated center pins. One of the nicest features is the fact that the adapters all fit in their individual slots in the case. You can tell at a glance if any of the components are missing, eliminating the "left it at the site" syndrome.

**The HCA-5001 Coax Adapter Cable Kit**

Once you've used the RF adapter kit for a while, you'll come to appreciate the pleasure of using just the right tool for the job. If you really want to pamper yourself, the next step is to pick up the HCA-5001 Coax Adapter cable kit. This kit consists of 20 three-foot RG-58 cables with a variety of mixed and matched connectors on each end. The styles are the same as listed above, with no SMAs, and with a couple of test clips thrown in. These connectors are the same high quality as the adapter set, and the cable is a flexible, easy-to-work-with type. And it's bright yellow, so you can tell at a glance if someone at another bench has "borrowed" one of your cables. Heathkit even throws in two wall racks so you can keep track of things.

Once you have the Heathkit adapter AND cable kits, there'll be no RF job you won't be able to tackle. This part of the job will become so easy you may have to hunt around to find something ELSE to complain about!

---

*Larry Antonuk WB9RRT has written numerous reviews on test equipment and electronics books. He currently works as a project manager for a land mobile service shop in Keene, New Hampshire. He enjoys home-brew projects, experimentation, and instrumentation. Contact him at P.O. Box 452, Marlborough NH 03455.*

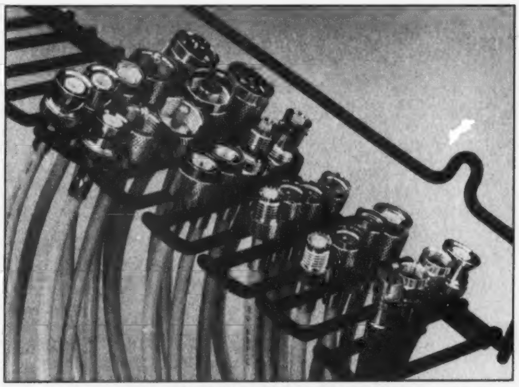

*Photo B. The HCA-5001 coax cable kit.*

**Number 19 on your Feedback card**

# The Worlds of Gus Browning W4BPD

## *Tribute to a DX pioneer.*

by Jack Parker K5CVD

*Gus Browning W4BPD, 1908–1990.*

Gus Browning W4BPD has become a silent key. To older hams, especially those in love with DX, that call means a lot. It rang through the airways from Maine to Mexico, from the Indian Ocean to the Pacific. Using over a hundred different calls from as many countries, the gentle southern "country boy" opened the door to country after country for the DX fraternity. He left behind friends of every race, color, creed, and social status. He was Elmer to commoners and kings, and one of the truest friends the Amateur Radio Service has ever known. In a word, Gus Browning W4BPD was special.

Gus was born on November 25, 1908 in Elloree, South Carolina, the third child of a poor farm family. His early life was filled with hardship, but as Gus put it, "We were a poor but happy family. No one ever told us we should be unhappy!"

### An Early Love

At the age of 16, Gus discovered the magic of radio, and it became a passion that would possess him for the rest of his life. Through the years Gus would travel the world seven times through hundreds of countries, and bring new countries to amateur radio and amateur radio to the world.

Gus's love affair with radio began one afternoon in front of an appliance store in Winter Park, Florida. In the show window stood an RCA Model IIIA radio tuned to KDKA. As Gus described it, the sights and sounds stopped him in his tracks. He had to have one!

The price tag on the radio was far beyond Gus's finances, but he would not be put aside. For the next several months he searched through every *Radio News* he could find. Finally, he found a "pictorial" (schematic) for an L.M. Cockaday two-tube radio. As was the case with his attitude toward poverty and unhappiness, there was no one around to tell Gus how tough a building job he had chosen for himself. With the same persistence that would later take him around the world seven times, Gus began collecting money and parts for his first radio. It took a year of assorted odd jobs, then weeks of wiring and soldering. Finally, the big day arrived. It proved to be one of the saddest days in Gus's life.

First, a couple of important facts. The house Gus and his family lived in was without electricity. The L.M. Cockaday radio was powered by two types of batteries: 1.5 volt A batteries and 45 volt B batteries. In his excitement to fire up his new radio, Gus mixed up the two battery types and applied 45 volts where he should have applied 1.5 volts. Scratch one tube!!! In Gus's words ". . . they say I cried all that night and the next day over my calamity!"

*W4BPD at his operating position in 1951. Much of his station was home-brew.*

Gus had no money for another tube, but his aunt came to the rescue and in a short time the new tube was in hand. This time he applied the correct voltages and the sounds of KDKA filled the house with "Dallas." Gus's father said to his wife, "It plays!"

### Wrong Code

In 1925 Gus was working for the Lowell Electric Company in Orlando, repairing radios and electrical appliances. He had read about amateur radio and had begun working toward a license. At the same time his oldest sister was trying to get a job with Western Union and found she had to learn Morse code. She and Gus worked together, and within six months they both were copying ". . . 15 or 16 words per minute." His sister Lorena went to Western Union to take the code test, only to discover that she had learned the code on a door buzzer that sounded nothing like the clicks and thumps of a Morse "sounder." She was heartbroken and never attempted to learn the code again.

Gus was also faced with a letdown, as he and his sister had learned American Morse Code, not International Morse Code! But Gus would not be stopped. Two hard years of shortwave listening later, with a lot of help from Clifford Wolking (now W4BNF), Gus passed his license test and became NU4ADB. Gus was on his way.

### A Ham at Last

Gus's first transmitter was a push-pull pair of 301A tubes with a filament power of 0.5 amps at 5 volts. Since there was no electricity in his home, Gus scrounged second and third-hand #6 batteries to power his home-brew rig. It was often disconcerting for him to watch five hundred volts drop to fifty volts when the transmitter was keyed. According to Gus, ". . . working DX was a joke!"

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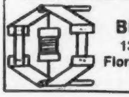

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Once again, the Gus Browning tenacity took over. He dipped into his dwindling savings and added another tube to his transmitter and added a counterpoise to his antenna. Time for the acid test. Gus called a D4 (Germany, at that time) and nearly "fell out of the chair" when his 5-watt signal was answered. Gus was hooked on DX. His new passion would be the main driving force throughout the rest of his life.

The continuing cost of batteries and the lack of work in the Orlando area soon drove Gus to seek a better life. At the invitation of his older brother, Gus moved to Philadelphia, Pennsylvania, where he got a job with the Philco Radio Corporation. His call changed to NU3BBH and later became W3BBH. Over the next several years Gus worked and played at radio in Philadelphia, and met and married his wife (Agnes) Peggy Smith. Life was almost as good as it could get.

*W4BPD's operating position, circa 1955.*

### Becoming His Own Person

Gus had always detested having to deal with a time clock. He dreamed often of the day when he would no longer be tied to someone else's idea of the right time to work or play. When unionization came to the Philco plant, it was soon followed by a strike that left Gus out of work. He seized the opportunity to get away from the big city and relocate to Orangeburg, South Carolina, and the gentle rolling hills he had left many years before as a child. His new call was W4BPD—a call that was to become known worldwide.

The first four years in Orangeburg, Gus worked for an electric company, repairing everything from fans and fences (electrical, of course) to radios. Then he had the opportunity to open his own radio and appliance repair business, and he did. No one ever again told him when to work and when to play.

Throughout Gus's years as an amateur radio operator, DX was his passion. He worked at it continually and joyously, but there was something missing. Gus's wife Peggy told it best in the January 28, 1970 issue of Gus's *The DXERS Magazine*:

"After many of his DX contacts, Gus would try to tell me about what these DX QSOs were like. He would even try to tell me how he thought things and scenery would be to these DX hams when they walked out of their front doors. He would get a sort-of-DX-gleam in his eyes...and the more DX he worked, the deeper this gleam would get. He said one morning (after he had been up since 5 a.m. working DX), 'One of these days I am going to be DX and see some of these rare spots.' 'Yes,' I would answer, 'and I am going to fly to the moon...' "

### Going DX

World War II came along and took amateurs off the air. When the word came allowing amateurs to resume their hobby, Gus was ready. Within 90 days, he worked over 100 countries, and won DXCC certificate #4 from the ARRL. He continued to chase DX for 14 years before his wish/dream finally became possible.

Gus Browning did indeed become DX! For ten or more years he traveled the world on one DXpedition after another. He circled the world seven times, and (according to Gus) was in every country in Africa at least three times. He signed over a hundred different callsigns all over the globe. He was Elmer to kings and a friend to amateurs everywhere he went.

Gus's first trip abroad was financed out of his own pocket. In Gus's words: "After chasing DX for 14 years I finally sold a small tract of timber I had on that 152 acre farm for $3750.00, and that's when I said, 'I am going on a DXpedition!' "

Gus's destination on that first trip was the Seychelles Islands in the Indian Ocean. In later years he described the Seychelles as his idea of paradise, and he returned there many times. Throughout his travels the Seychelles remained his favorite place.

### A Magazine for DXers

Aside from the many new countries Gus made available to DXers worldwide, Gus made a much greater contribution to the DX fraternity. Following his 1966 DXpedition, he started his own magazine dedicated to informing DXers of rare countries and DXpeditions. *The DXERS Magazine* published over 500 weekly issues in its time, and for Gus was another new adventure. He tells it this way in the December 24, 1969 edition:

"Upon returning from my 1966 DXpedtion, I were [Gus never learned to conjugate the verb "to be"] asked by a number of DXERS to take on the task of putting out a magazine strictly for DXERS since I been on both ends of DX and should know a little bit more about the game than the average ham. Having been a DXER since 1927 certainly qualified me from the angle of the USA DXER. But having not been trained to write what I had learned and not knowing anything at all about printing I had my doubts if I could successfully put out a magazine that the boys would subscribe to."

But Gus did put out a magazine, and it was well read. In each issue, he wrote a column that he eventually called "Straight from the Horses Mouth," (with his own brand of spelling) filled with tales of his life, his travels, and his philosophy.

From mimeograph to offset, from stumbling to running, Gus kept his friends around the world informed. When he was traveling the world, his wife Peggy, daughter Joann, and son Gus, Jr. ran the show, keeping everyone posted on Gus's adventures to date and plans for the future. While it was never elegant, it was always informative and ALWAYS fun!

Gus Browning was a pioneer. His life can best be summed up in the philosophy he lived by: "We were happy, 'cause nobody told us we shouldn't be!" He was successful as a DXER because no one told him he couldn't be. He was successful as a publisher (in his own special down-home way) because no one told him he couldn't be. His contribution to the hobby was considerable. We shall miss him.

---

*You may reach Jack Parker K5CVD at PO Box 356, New Ellenton SC 29809-0356.*

*Gus and Peggy Browning. Photo by Skip WB8OWM.*

Number 20 on your Feedback card

# HAMSATS

## Amateur Radio Via Satellite

*Andy MacAllister WA5ZIB*
*14714 Knightsway Drive*
*Houston TX 77083*

### Hamsat Antennas

Orthogonal, or mutually perpendicular, antennas are commonly used for satellite communications. The crossed yagis of Cushcraft, Telex/Hy-Gain and KLM are good examples of commercially available yagis providing linear or circular polarization, depending on the harness configuration.

Our VHF/UHF satellites like AMSAT-OSCAR 10, AMSAT-OSCAR 13, Fuji-OSCAR 20 and the Microsats all transmit their downlink signals using circular polarization. Simply buying a commercial antenna with a polarization switcher will provide the appropriate equipment for receiving satellite signals—at a price.

The basic Telex/Hy-Gain system, the 218S, goes for $300. It includes antennas for 2 meters and 70 cm, has stainless-steel hardware, and incorporates polarization switchers for each band and a Fiberglas™ boom for mounting through an elevation rotator. This represents the most cost-effective system for performance versus price, though adding rotators for moving the array in both azimuth and elevation makes it pricey.

The Cushcraft satellite antennas are cheaper, until the polarization switchers are added, while the KLM system is the most expensive. It is possible to have as much as $1,000 tied up in a satellite antenna system after the coax, connectors and rotators are added. A viable alternative is to build the antennas, keep the feedline short, and use inexpensive "TV" rotators or secondhand ones from a swapfest.

**Building Antennas**

Hamsat antenna construction projects can be found in *The Satellite Experimenter's Handbook* by Martin Davidoff K2UBC. They range from simple turnstiles to more exotic helix types. This book also discusses the use of crossed yagis and parabolic dish antennas.

The *1990 ARRL Handbook* discusses system configurations in the "Space Communications" section and presents some good VHF and UHF designs in the "Antenna Projects" chapter. Back issues of *73* are also excellent sources. The May 1989 issue presented a "Home-Brew 435 MHz Crossed Yagi" by Keith Berglund WB5ZDP and Doug Howard KG5OA. This issue also had articles on 1.2 GHz systems, polarization/matching circuits, mode "S" (2.4 GHz) receive techniques and "AANother Turnstile Antenna" by Henry Falkner ZL1AAN.

Many of the construction articles found in books and magazines prefer yagis for 2 meter and 70 cm operation. When two yagis are positioned in a mutually perpendicular fashion to form an "X," and are fed properly, a circular or linear polarization can be achieved.

The Cushcraft 2 meter "twist" represents the simplest form, with both yagis on the same boom and without physical staggering of the elements. The orthogonal driven elements are separated only by the physical constraints of the hardware, as are all of the other elements including the reflector and the directors.

Linear polarization is achieved simply by connecting the driven elements together through a power divider composed of 75 ohm matching sections of coax. To get circular polarization, a quarter-wave piece of 50 ohm coax is placed in line with one of the two yagis before the matching section. Instructions with the antenna show the location for the 50 ohm delay line, depending on whether you want left-hand or right-hand circularity.

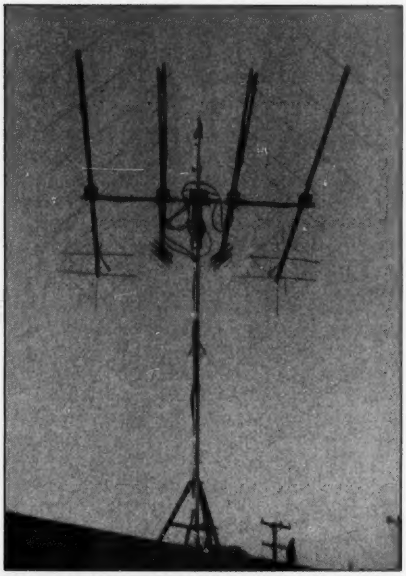

*Photo A. Orthogonal quagi antenna array at N6JJI. (N6JJI photo.)*

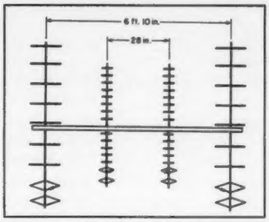

*Figure 1. Orthogonal quagis—top view.*

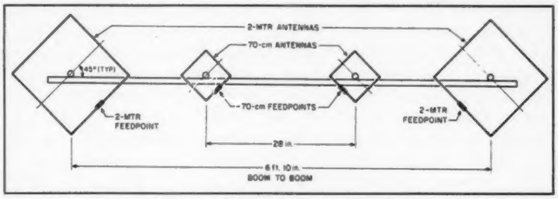

*Figure 2. Orthogonal quagis—rear view.*

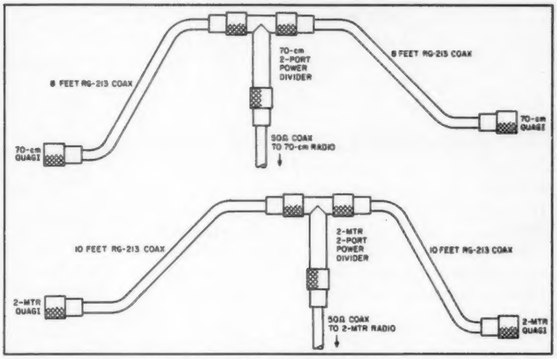

*Figure 3. Quagi feed system.*

Other manufacturers and some construction articles use staggered elements where the orthogonal yagis are physically shifted with respect to each other along the length of the boom.

The yagi in one plane is positioned a quarter wave ahead or behind the other. When the two are fed with a power divider, the effect is a circular pattern, thanks to the physical shift of the antennas along the boom. To get the opposite circularity, a half-wave delay line is switched into one feedline before the divider.

**Orthogonal Quagis**

Quads and quagis are three-dimensional so they cannot be used on the same boom for orthogonal systems, although some interesting experiments with staggered element positioning might be possible. It is much easier to mount two quads or yagis with mutually perpendicular positioning on a cross boom with some distance between them, typically one wavelength. A good satellite antenna system can be constructed using a delay line and matching network with a polarization switcher.

In the September/October 1983 issue of *Orbit* from the Radio Amateur Satellite Corporation (AMSAT), Martin K2UBC presented some interesting findings about circularity and A-O-10 operation. The article "Off-Axis Circular Polarization of Two Orthogonal Linearly Polarized Antennas" showed that since the 2 meter and 70 cm antennas on A-O-10 (and A-O-13) are part of a phased array with separation on the order of a wavelength, ground stations can experience apparent polarization shifts whenever the satellite is not "aimed" directly at the user. For those stations using physically-separated, mutually-perpendicular gain antennas, the effects of these shifts can be minimized or eliminated via slight off-pointing.

The off-pointing polarization shift is caused by the physical difference in distance to the satellite between one yagi, quad or quagi with respect to its orthogonal counterpart.

If four antennas are placed on the same boom as shown in Figure 1 (two for 2 meters and two for 70 cm), fed by equal lengths of coax as shown in Figure 3, they will exhibit linear polarization directly in line with the array. When they are aimed 14.5 degrees either to the right or left of center, the effect is circular polarization, left-handed or right-handed respectively, in line with the distant observing station or satellite.

Photo A shows the orthogonal quagi array at the home of Alex N6JJI. The August 1989 "Hamsats" column featured Alex's dual-band corner reflector for satellite operation. His quagi array provides circular polarization using the method of off-pointing described above. The quagis are generic types described in *The ARRL Handbook* from at least 1979 through 1989. The 1990 *ARRL Handbook* did not reprint this popular design. Using antennas with moderate gain and wide beamwidth, the off-pointing method of circularity switching can more than compensate for the gain pattern rolloff.

Physically-separated, linearly-fed orthogonal antennas are simple in de-

*Continued on page 60*

Number 21 on your Feedback card

## Hams Around the World

*Bob Winn W5KNE*
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### A51JS: The Kingdom of Bhutan

*Adapted from a DXpedition report by Jim Smith VK9NS/A51JS.* When I stepped on the plane at Norfolk Island that Sunday, it was hard to believe that my destination was the Kingdom of Bhutan. The very name of this remote and isolated country conjured up all sorts of images. The little that I had read seemed to indicate a move on the part of the country into the 20th century. H. M. Jigme Wangchuck, ruler of the land of Druk (the thunder dragon), has steadily moved his country forward, on many occasions embracing Western technology. Yet, magically, so far he has been able to keep the country's culture intact. Tourist entries are kept to a minimum so the visitor witnesses real life rather than the tourist-oriented hype found in so many places.

A few years ago you had to enter Bhutan via India, through the southern foothills of the Himalayas. Many hours of travel later, via a winding, climbing thread of a road clinging to the edge of the mountains, the traveler arrived at Thimphu. The road started off at a tropical 500 feet above sea level, then rose to just over 7,500 feet in Thimphu, the capital. Thimphu nestles in a valley more or less surrounded by high mountains on all sides.

My journey was to be much easier: Norfolk Island, Auckland, Bangkok, then Dhaka in Bangladesh, and finally Paro in Bhutan. It was only a couple of weeks previously that I had received the telex which said in part: "Permission is granted to enter Bhutan as a common tourist, amateur radio permission will be granted on arrival, subject to checks of radio equipment." Thus, in over three years of communication and contact with the government of Bhutan, a germ of an idea had come to fruition.

#### The Route to Bhutan

It was a mad rush to get things organized, and several things did not gel. Several promised items from Japan and the U.S. simply did not arrive, due to air freight difficulties on the Bangkok–Bhutan leg. As a result, there was no beam, no additional coax (for other antennas), no 6 meter rig, and so on. However, I left Norfolk Island with two rigs, an ICOM 740 and an ICOM 751 (JA version), 30 meters of coax and a Butternut HF6V vertical antenna.

However, I carried a great deal more. On check-in at Norfolk Island, I was carrying 70 kilograms of excess baggage. I usually have several items of baggage and I invariably carry a rig on board as cabin baggage.

It was later in Auckland that I had my first shock. A change of airline schedule had me leaving on Thai Airways for Bangkok, several hours earlier than planned. As I checked into the Thai counter, the girl was quick to point out that my baggage was overweight. And, she wasn't too happy about the 12 kilograms of cabin baggage, either. Ten minutes later I was spending US$750 on excess baggage, despite her slashing almost 30 kilograms off my official weight and closing her eyes to my "cabin baggage." A charge for 30 kilograms at US$25 per kilo was disillusionment indeed.

**A51JS QSO Breakdown**

| Band | CW | SSB |
|---|---|---|
| 10m | 1,682 | 1,607 |
| 15m | 2,105 | 2,537 |
| 20m | 3,056 | 2,767 |
| 40m | 828 | 10 |
| 80m | 98 | |
| Subtotal: | 7,769 | 6,921 |
| RTTY | | 182 |
| Total: | | 14,872 |

Several hours later we landed at Bangkok Airport. I have nothing but praise for the facilities there. I approached Customs with caution but, with just a moment's explanation, I was waved through with a smile. A few minutes later, with real Thai currency in my pocket, I was in a taxi on the way to the hotel in town. With three nights in Bangkok, I spent Monday and Tuesday trying to locate the freight that I was sure was waiting for the flight to Bhutan. I also had to organize my entry visa. Some US$690 later I had my round-trip ticket to Bhutan. I was ready for the flight due to leave on Wednesday morning.

They meant **MORNING!** With check-in time at 0630, and an hour's drive from town to the airport, I was up at the crack of dawn. I was really worried about the excess baggage, with visions of much of it being off-loaded, but check-in at the Druk Airline counter was uneventful. The check-in girl was delightful, hardly batting an eyelid as my main items were handed over. Then she spotted my cabin baggage. "Perhaps it would be more comfortable if it was loaded with the rest," she suggested. Not a murmur as the scales went up another 12 kilograms. After a very token charge of US$200 I was breathing freely again.

#### Finally, Paro

The approach to Paro seems to be a real test of pilot skill (not to mention passenger nerve) as the plane lets down, winding and twisting through the mountain valleys. Finally we were on the ground and disembarking at the airport in the fertile Paro valley, 6,500 feet above sea level.

I had declared almost $4,000 worth of amateur radio equipment, so I was concerned! However, I soon spotted Sherab Dorji of the Wireless Division. After our formal introduction he took my customs declaration form. Each item was passed by customs as it was collected, and we were soon outside the airport. Over lunch I learned that I would be given permission to operate amateur radio and that Thimphu, our actual destination, was a couple of hours drive away.

The journey to Thimphu was my introduction to the winding, climbing roads of Bhutan. The sealed road was in excellent condition and, as we climbed higher and higher out of Paro, the views were tremendous.

By the time I had checked into the Hotel Motithang and all my baggage was safely unloaded, it was late afternoon. We all sat around relaxing and talking, and we decided to look at the radio equipment in more detail. With several willing helpers we soon had the main items unpacked. A look out of the hotel room window (on the ground floor) showed that getting the Butternut vertical organized would be easy. Indeed, with the help of Sherab and others, the antenna was assembled and erected within 30 minutes (I have it color coded for quick assembly). There was one slight hiccup—my multi-point extension cord would not fit into the hotel power point. A quick fix involving matches and stripped cable ends made power available. The next day, after a quick trip to the local electrical shop, I had a safe power connection to the hotel power outlet.

We switched on the IC-751 and, after a few minutes of quick demonstration of the main controls and a discussion about power output and frequencies, I had the go-ahead. A "CQ" call was answered at 1143 UTC on 21st March and, after an eight-year lapse, the Kingdom of Bhutan was once again active on the amateur bands—A51JS was in QSO with YB5BZ on 20 meter CW on 14020 kHz. This statement does not really do justice to the actual situation or truly reflect the tremendous trust and genuine interest on behalf of the Wireless Division of the Royal Government of Bhutan. Eight years is a long time in amateur radio terms. It means, for example, that thousands of hams have never heard Pradhan A51PN who, for over four years, in the late '70s, had been the sole "voice" of Bhutan.

Sherab Dorji of the Wireless Division mentally copied this first QSO and the subsequent ones. He was smiling broadly. Was he also glad that amateur radio was on its way again? I like to think so. The eruption on the band increased as more and more people realized that they were listening to activity from Bhutan. Just over an hour later I picked up Kan JA1BK on CW, a quick QSY to SSB. This was the first A51 SSB phone QSO in over eight years. Kan also telephoned Kirsti VK9NL, Jim's XYL, and a day earlier than expected we were in QSO. Shortly after that there was a break for an hour or so. Sherab and others had to leave but we arranged an appointment for the next morning to finalize permission. Then I would get an official letter of authorization. In the meantime, if I wished to continue to operate, that was agreeable.

Over the coming days and weeks I grew to respect the Bhutanese people more and more. They have to be one of the most open and honest people in the world. Sherab and others were determined about one thing: I had to be shown something of Bhutan. I was not going to sit in front of the rig day after day; there were things to see and do. As a result, I did four main things during my stay: I slept, I operated amateur radio, I became a tourist (without really realizing it), and I discussed amateur radio at length—amateur radio regulations, frequency allocation, power, band planning, and so on.

#### Operating From Bhutan

In the early days there was some frustration. I found it quite cold and sometimes uncomfortable, and there were many power cuts. Sometimes the power cuts lasted only a few minutes, sometimes an hour, and sometimes longer. It seems to me that on occasions Murphy picked the most inconvenient times, usually late afternoon as the band was opening up to the US, often in the middle of my sked with Kirsti. Propagation openings, especially to the different areas of the US, were very short. I used the DX Edge and it was just like working on 80 meters. Gradually, though, the QSO rose and more East Coast, West Coast, South America, Europe, and so on were logged. Of course I worked many JA stations as they were almost always in skip.

The HF6V was at 7,500 feet. However, the hotel was tucked up at the end of a valley with mountains all around. Often the incoming signals (in particular those from North America) were almost unreadable, due to flutter. I put this down to polar effects, but I also think that there were many multi-path reflections because of the surrounding mountains. Many US amateurs have also commented that there were wide variations of beam headings for the A51JS signals.

Quite often my power output was around 80 watts key down on CW. It

*Continued on page 68*

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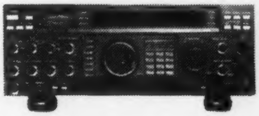

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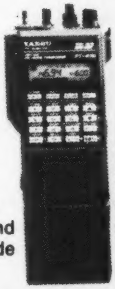

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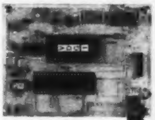

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### More Stage-by-Stage Hunting

Let's continue last month's discussion on how to recognize circuit stages. Here goes:

**Transmit drivers:** These are usually made from transistors, although they may be ICs in walkies and some VHF/UHF mobiles. There may be several stages, with the last one leading to the final amplifier. Look for coils. In HF rigs, they may connect to the bandswitch or band switching relays, and the coils will most likely be found there. In VHF/UHF equipment, the coils are often just a few turns of wire, perhaps ¼" to ½" in diameter, with no core. Look also for trimmer capacitors. The driver transistor just before the final amp will probably have a heat sink, or it may be bolted to the chassis. Also, the predriver, which feeds the driver, may or may not have a heat sink.

### More Stages

**VFO:** This is an oscillator, whether digital or analog. The analog variety is simple. Look for a big air-gap tuning capacitor. A few HF rigs use "permeability-tuned" oscillators. This is just a fancy way of saying that to vary the frequency, they move a core in and out of a coil, instead of using a variable cap.

Above HF, there are very few non-synthesized VFOs. There is either a crystal oscillator or, in rare instances, a varactor diode tuning arrangement. The varactor looks like a combination diode/capacitor on a schematic, but it functions like a voltage-controlled capacitor, and actually has no diode-like properties. It simply changes capacitance when the DC voltage on it varies, so you can tune with a pot instead of a cap.

The digital variety is quite a bit more complex. It usually involves an analog varactor-tuned oscillator driven by a messy digital system. Basically, the digital stuff examines the frequency of the oscillator and, using a DC control voltage, shifts it until it matches a square wave generated by the digital circuitry and referenced to a crystal. In this way, the analog oscillator can be set to many different frequencies, yet have the long-term stability of the crystal. In other words, no drift.

Some new HF synthesizers use a direct sine wave synthesis scheme, avoiding the analog oscillator altogether. Instead, they construct a sine wave from digital steps and then filter it, just like a CD player reconstructs music. In radio gear, this technique is called direct digital synthesis, and I expect it to become more and more common.

Regardless of its construction, what you are looking for is a sine wave signal at the output of the VFO. With the exception of a direct digital synthesis circuit, lack of output means the analog oscillator is not working. Even in a synthesizer, the oscillator should still run, regardless of the state of the digital system. It may, however, be way off frequency if the synthesizer is broken.

Check the output with a scope. It should be a few volts peak-to-peak, or more. If it is missing altogether, check the transistor or FET, which is directly connected to the tuning cap or variable coil. If there's power but no signal, the transistor is probably bad. If the signal is there, check the buffer transistor which follows the oscillator. Often times, that's the one that dies, because it has to handle more power.

Whatever you do, resist the temptation to turn trimmers or adjust coils. If the oscillator is dead, it is almost certainly *broken*, not out of adjustment! Once you mess with those settings, you will be sorry later, I promise.

**Local oscillators:** These are just about always crystal-controlled. Like VFOs, they should have a few volts peak-to-peak or more at their outputs. If not, check the transistor connected to the crystal. If it is good, suspect the crystal itself. Especially in older rigs, the rocks seem to fail in a random fashion. Also, if the oscillator is dead but can be brought to life by tapping on the board, check for cold solder joints. If there are none, the crystal is the likely culprit. The same holds true for any oscillator that comes and goes by itself, again, as long as there are no cold joints.

**Receiver front ends:** Their job is to amplify and bandpass-filter the incoming signals and send them to the mixer. They deal with extremely weak signals, and cold solder joints can really mess things up. Always look for them first. Then, work backward from the mixer, using a signal injector.

The safest way is to use a signal generator fed through a discharged 100 pF cap. You can make one from any astable flip-flop or timer. The square wave output will have plenty of harmonics and should be audible at least through HF, perhaps higher.

I suggest signal injection because looking for incident signals with a scope is likely to be fruitless. The signals are too small and there may be many of them at once, causing the display to appear to be nothing more than low-level noise. It can be very hard to tell whether the stage is working or not. Injecting your own signal just makes it a whole lot easier.

**Mixers:** These have two inputs and one output. One input comes from the front end (or mike amp, in the case of a transmitter) and the other comes from the local oscillator. Many apparent mixer failures are caused by a missing input! If they're both there, check the output, which should lead directly to the first IF or transmit filter. In the case of a diode-ring mixer, which looks like a bridge rectifier, one diode could be bad. An IC mixer either works or it doesn't. A balanced-transistor arrangement could have a bad transistor.

The easiest way to tell is to check and/or change them, one at a time. Be sure, though, to mark which goes where. In a balanced circuit, putting them back in each other's places could cause circuit unbalance and require realignment. If you do replace parts, you'll probably have to rebalance the circuit anyway.

**IFs:** These are basically bandpass amplifiers. That is, they amplify only the frequencies within their bandwidth and attenuate all others. Usually, failure means complete, or nearly complete, loss of signal. When tuned to a station, you should be able to see a signal at the IF frequency which gets bigger at the output of each stage. The output, by the way, will be where the transistor collector meets the IF coil. If the stages are made from ICs, check where a lead from the chip meets the coil.

It is very important to note that the IF stages are gain-controlled from the AGC amp. If the AGC voltage, which is a varying DC level, should go way off, the IFs can look dead or weak, even though they are just "obeying orders." If, on the other hand, there is too much IF gain, the AGC is the first place to look. It's highly unlikely that an IF stage has started to work too well! If all the stages and the AGC amps seem OK, but there's still no output going to the detector, check the ceramic, crystal or mechanical filter. It should be fairly large in HF rigs, but may be small in VHF or UHF sets.

If it has input but no output, try jumping across it with a 0.1 µF cap. If you get a good signal, you've found the problem. If there's still no output, try removing the filter and jumping the connection again. If that does it, the filter may be shorted to ground. Note that it is normal for the signal coming out of the filter to be significantly smaller than what went in. If jumping it only brings things up slightly, you're looking in the wrong place.

FM rigs deliberately drive the IF stages to saturation. This technique is called "clipping," or "limiting," and the purpose is to remove any amplitude variations from the signal. Along with the AM components go noise spikes and most other interference. It is this vital characteristic which gives FM its nearly noise-free performance. It is also the reason for the loud "whoosh" sound you get with an open squelch on a blank frequency. You can use this to great advantage in a repair job. If you get the loud whoosh, the problem is most likely in the front end, not the IF. If all you hear is audio amp hiss, with no whoosh, the IF is the place to look.

**AGC amps:** These control the IF and/or front end gain. They work by varying the gain of one or more stages with a voltage derived from the signal strength of the tuned station. The signal is usually picked off near the last IF, after the filter. That way, signals outside the filter's bandpass won't clamp the receiver gain down. In some rigs, the AGC is derived from the audio after detection. This is considered an inferior technique, found mostly in older rigs and QRP equipment.

The AGC amps drive the S-meter, pushing the S-unit reading up as they clamp the gain down. This makes the meter a valuable instrument. If it is pegged and the rig is silent, check for a shorted AGC transistor. If it is at S-0 and the rig is silent, at least you can be pretty sure that the AGC isn't clamping off the IFs. If the receiver sounds overdriven and distorted, but the needle doesn't move, the AGC amps aren't doing their job.

Trace back from where the first amp gets its signal, and try to find the point at which it is applied to a cap to change it to varying DC. There will probably be a diode feeding this cap. If there's no voltage on the cap, you're close to the problem.

Well, there's plenty more to go in this discussion, so we'll save the rest for next month. You may notice that I've concentrated on receiver troubleshooting, and hardly mentioned transmitters. Many stages are common to receive and transmit, and most signal problems will affect both. It's simply easier to fix a rig set for receive than for transmit. It's also safer. If the problem affects only transmit, that's a good clue because it instantly eliminates from consideration all circuitry shared with the receiver. The same troubleshooting techniques apply, and the signal paths are much the same.

With a transmitter, of course, the start of the process is the mike and mike amp, instead of the front end. And, of course, the end of the process is the final amp and antenna instead of the speaker. Other than that, there really isn't much difference. Both use mixers and IF stages of some kind, although in transmitters they may not be called IFs and they may have fewer stages.

**Dear Kaboom,**

*Here in my apartment building in Spain, my HF receiver is getting wiped out by a 5 kHz wide signal appearing every 14 or 15 kHz, all over my dial. I suspect that it is from the horizontal oscillators of nearby TV sets. My receiver is a nice old Drake and I don't want to trade it in. How can I filter this mess out?*

*Gettin' Buzzed*

**Dear Buzzed,**

First the good news: You don't have to trade your rig in. Now the bad news: It wouldn't help if you did! You're right—this noise is undoubtedly coming from your neighbors' TVs. Unfortunately, it is really there, on your receiving frequency, and there is no way for your rig, or any rig, to tell the difference between the hash and the signals you want to hear. It is not of an impulse nature, so a noise blanker won't help.

It's conceivable that some of it could be coming through the power line, so trying a line filter might not be a bad idea. Most of it, though, is probably coming right through your antenna. I doubt if you can get rid of it, but a different antenna may help cut it down a bit. In particular, stay away from end-fed, unbalanced antennas. Try a dipole with a balun, or better yet, try a beam.

There are exotic approaches, such as using a separate sense antenna and subtracting the noise, as is done for VLF loop antenna setups. It is likely, however, that you'll just have to live with it. Who said TVI is always our fault?

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I need info on how to build, or where to buy, an SCPC Receiver with AFC and an accurate digital readout for around $100. *L. Epperson, 105 Hollywood Dr., Glen Burnie MD 21060.*

I need a manual for an Atlas 350-XL Transceiver. *Robert Rice, PO Box 53798, Houston TX 77052-3798.*

Blind, handicapped young man, a shut-in, would like to hear from people and seeks someone to donate a portable or table size shortwave radio receiver. Phone *(213) 938–5347* or write, he welcomes letters. *Richard Jartrow, 5909 West 6th St., Los Angeles, Calif. 90036.*

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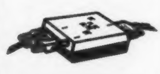

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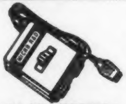

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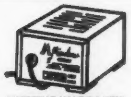

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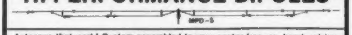

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## Just Do It!

Every time someone gets an idea to try to implement something new or innovative, someone else will inevitably be there to give them all the reasons why it will never work, can't be done, shouldn't be done, and why they shouldn't waste their time trying. It's amazing how many people, who generally do nothing themselves, are always on the sidelines to make sure no one else tries to do anything, either.

It's a sad commentary that most accomplished people in history had to call upon their own inner resources to persevere over the objections, ridicule, and negativism of others. What is it these "others" are afraid of—that you will succeed? Perhaps it's that they are so afraid of failure themselves that they don't want anyone else showing them up. What's wrong with failure, anyway? That's how we grow and develop our strengths and skills, and move on to our best successes.

At the beginning of every school term, I hang up a sign in our classroom ham shack that says, "Just Do It." Before I begin doing anything at all in my classes, I set the tone and attitude for the whole school year. We're going to follow the rules and standards we set down at the beginning, and we're also going to try new things, to explore and to experiment.

One of the key ingredients in a successfully run school program is a motivated, enthusiastic instructor. How excited can you be if you're doing the same old stuff over and over again? The beauty of amateur radio in a classroom is the wide variety of new experiences you, as an instructor, can enjoy if you're flexible enough and willing to try new things.

### Getting Ready to Do It

I stress the value of preparation as a first step with my classes. We discuss the need to think through new ideas and to carefully evaluate project suggestions. The next step is to prepare the best that we can to implement our goals. If it works—great! If it doesn't work—that's all right, too. We can always gain something from a well-thought-out effort. In my class, it's the dedicated attempt that counts almost as much as the success. Not trying for fear of failure is the cardinal sin.

Over the years, many of the youngsters have confided in me that they were afraid to take the license exam for fear of failing it. I always try to make the kids understand that it's the effort that goes into something that really counts. If you don't pass an important test the first time, learn where your weak points are and try to master them. If you want something badly enough in life, you must be willing to keep on trying to knock down obstacles until you get it. Never allow yourself to become paralyzed because of that terrible word "failure." Just do it!

It's always easier to make a case for why you shouldn't try something new or difficult. It's simply less bothersome not to disturb the status quo, not to rock the boat, not to make waves. Notice all the idioms and caveats we have in our language to encourage the idea of doing nothing. We'd still be writing with quill pens by candlelight if it weren't for the achievers among us who *just did it!*

### Beginnings of "Introduction. . ."

Nine years ago I met with this kind of negativism when I decided to try implementing a program called "Introduction to Amateur Radio" in a New York City intermediate school. Almost everyone around me assured me it would never work and that I was banging my head against a stone wall. Even if I did somehow manage to get it through the incredible beauracracy of the New York City Board of Education and convince a principal to let me try it, who would support it? And how would I keep the kids interested in something so technical?

I've never really been sure where stubbornness ends and determination kicks in. In either case, I prepared, and began to gather the resources I needed to implement my plan. It wasn't easy by any means, but tell me about something really worthwhile that was ever easily attained. As I look back over the past nine years, I realize all the things that could have gone wrong, or could have happened differently, but didn't.

The amateur radio program is one of the most popular classes in our school today, with close to 800 highly motivated youngsters coming through it each year. For all the negative and pessimistic people, there were enough supportive and encouraging people, like Stanley Katzman, Principal, and ham friends like Vince K2VJ, Ed KA2TXL, Roger W2SLP, Hip N2FDJ, Steve WA2DHF, Art K2BSJ, Walt W2ELM, and Bro. Joe AC1U. These were the folks who were there for me at the beginning, *before* the course was a success. I will always be grateful.

My advice is to surround yourself with people who believe in you and who will help you with your dreams and goals. Try to get good people to work with you. Networking with creative, talented, cooperative people is the real spirit of amateur radio, isn't it? A well-prepared attempt at something you believe in is what builds character and stops us all from stagnating as individuals and as a society.

This very strong philosophy of mine is what I was thinking about the other day as I mentally reviewed how much amateur radio had helped change the lives and directions of many of my students who had risen to the challenge.

### Mary KB2IGG Speaks Out

One of the youngsters who wasn't afraid to fail is Mary Alestra KB2IGG. A shy, soft-spoken 6th grader when she first entered my ham radio class last year, she went on to become the Westlink 1990 Young Ham of the Year. I sensed something special about Mary right from the start. There was a drive and a determination along with a real love for what she was learning. With over 9000 young people having gone through my program, a youngster has to be really special to impress me. Mary is such a youngster. She impresses me daily with the way she handles herself as a student, as a radio operator, and as a young lady.

*Carole Perry WB2MGP, Mary KB2IGY, and Mary KB2IGG, award winner, are on the classroom rig every morning.*

Mary studied hard to get her Novice ticket last year, and even had to take the code part twice. She was very hard on herself, and doesn't like to accept failure. With lots of encouragement from her parents and teacher, and an incredible self-determination, Mary went on to get her Advanced license, and is now studying for her Extra. Mary has gone from a shy, studious girl to a confident, poised, and somewhat extraverted 12-year-old right before my eyes.

At the ARRL National Convention in Kansas City, Missouri, this past June, Mary brought the audience to their feet with a standing ovation for her acceptance speech as the 1990 Young Ham. I think that if we work hard at it, and we're really lucky, Mary may be representative of the future of amateur radio. Here is an excerpt from the acceptance speech of this incredible youngster who just did it!

"Amateur radio has played a big part in my life ever since June of last year. It was then that I was first introduced to the hobby, at Intermediate School 72 in Staten Island, New York. I was very interested in Morse code, a new and challenging language, and truly enjoyed operating voice around the world from our school's ham shack. After seeing and experiencing how much fun ham radio can be, and realizing the tremendous benefits to be gained from being a ham, I studied on my own, received my Novice ticket and set up my own shack soon after.

"Since then, ham radio has proved invaluable to me in my school subjects. I find that I have progressed in my geography and science skills, as well as in math and language arts. Listening to the dialects of those many foreign hams has no doubt aided me in my foreign language studies.

"I've made many new friends through ham radio, adults as well as children. We often become pen pals and exchange pictures and other articles. We always find it interesting to get the inside report on events happening in their part of the country and how they are affected by it.

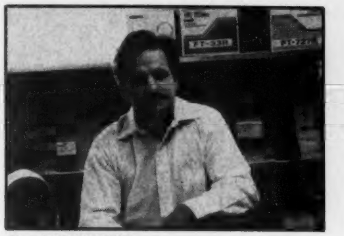
"Through ham radio, I have become more aware of current events throughout the world, and how big a part we as hams play in emergencies and disasters, as well as in local events, and how valuable we are to our communities. I, myself, have provided communications back to school on grade and class trips to other cities and amusement parks.

"Ham radio has so much to offer, and so many benefits and privileges to enjoy. Whether it be rag-chewing with the local hams, DXing overseas, packet, or code, everyone enjoys and benefits from at least one aspect of our hobby. The really great thing about it all is that what you learn now can certainly be applied in the future when trying out for that school you'd always wanted to go to, or that job you'd dreamed of getting. I myself plan to pursue a career in communications, and I truly feel that ham radio will help me carry out those plans in years to come.

"I really can't express how proud I am to receive this award tonight, but I do hope that in my receiving it, I will encourage other young people to get started in this most worthwhile hobby and service, and to succeed in its many aspects. The most important thing is not the fancy equipment or the 70-foot tower, which I can tell you from experience isn't necessary. Running 25 watts into a 54-inch portable antenna, I have contacted Russia, various parts of South America, Puerto Rico, maritime mobile stations in the Gulf of Mexico, and many local hams as well. What really counts is the effort you put into it and the motivation you give yourself. If you really want to be a ham, in time you will be, and you will enjoy the many privileges being a ham has to offer. I hope that other children will realize that the time and effort put into ham radio will be well rewarded, and the pride gained from being a ham will last forever." 73

Rob, WA3QLS

Gail, KA3ITN



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**73 Review**

*by David Love NU3T*

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What do you do when your repeater is located where there are no phone lines and you don't want to fool around with full-duplex phone links? That was the dilemma facing the Blue Knob Repeater Association when they erected their UHF machine. An autopatch isn't a necessity on a repeater, but it sure is a nice feature.

The association's secretary had noticed an advertisement in a trade magazine for CELJACK, a device that interfaces to a cellular telephone and provides a standard RJ11C phone jack for direct connection to a telephone. The CELJACK takes care of loading the number delivered to it via either dial pulse or DTMF tones into the cellular telephone and, in essence, tells the phone that the SEND key has been depressed. At the end of a call, when the controller puts the CELJACK back on hook, the interface tells the cellular telephone that the END key has been pressed and the call is terminated. In addition, the regular cellular telephone handset is still connected at the site, so we would have a telephone available when we go to the site to work on the repeater.

We were fortunate enough to have two cellular telephones, donated by members, for use by the association. After checking with Advanced Computer Controls for information about interfacing with the ACC RC96 and 850 controllers, we decided to try a CELJACK.

### Performance in the Field

The results were interesting. The RC96 controller plugs directly into the RJ11C jack on the CELJACK and the controller operates just as though it were connected to a standard telephone line. The only difference that the user sees is the additional time it takes for the cellular telephone to access a cell site and establish its call. All told, it takes only about seven seconds for the call to be connected once the patch is dialed. Something inherent in the cellular network, not the CELJACK, causes the delay.

The CELJACK worked so well at the UHF site that we decided to install one at the VHF repeater site. The K3OIH VHF repeater on 147.15 MHz is located at the Blue Knob Ski Resort in south central Pennsylvania. The machine has fantastic coverage, providing communications on a 200-mile stretch of the turnpike.

Although regular land line service was in place at the VHF site, the commercial rate that the association was paying was within two dollars of the cost of cellular service. This, coupled with the limited local calling of the regular phone service, was stacked up against the extensive local calling area of the cellular network. Cellular technology let us provide local calling into two area codes—over 150 exchanges.

Now, members from the local area, as well as from Pittsburgh, can use the patch to call home and advise friends and family of their well being without the need of relaying messages.

For the Blue Knob Repeater Association, the CELJACK was the answer to our autopatch problems. Now, if we could just figure out how to get free cellular service . . .

---

*Contact David Love NU3T at RD 1, Box 186-B, Williamsburg PA 16693.*

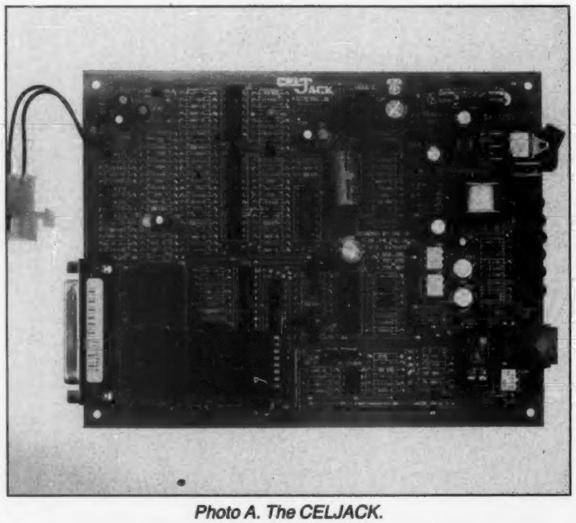

Photo A. The CELJACK.

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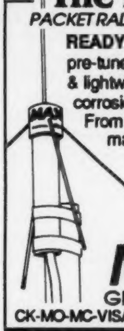

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| 1st H-Plane | - 16 dB |
| SWR | 1.10:1 typical |
| F/B ratio | 25 dB |
| Impedance | 50 ohm |

**MECHANICAL SPECIFICATIONS:**

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| Length | 17ft |
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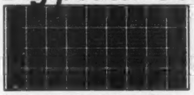

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| Kenwood—AT-250, PS-50, 430 | 70093 |
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# Hamsats

*Continued from page 51*

sign and easy to use. When A-O-10 or A-O-13 is within view, the antenna array can be aimed at the satellite and then the azimuth can be "tweaked" for the best received signal. The obvious drawback is what happens when the satellite moves with respect to the ground observer.

Signals will fall off or exhibit "spin modulation" faster than with typical crossed yagis or helix types. It might be very difficult to get good reception from fast-moving satellites in low earth orbit, but the elegance of the system and its ability to correct for home-brew construction errors in matching harness lengths and quagi construction (typically widebanded) can overcome the disadvantages.

### More DSP

The September 1990 "Hamsats" column provided a first look at the AEA DSP-1232 and the DSP-2232 multimode data controllers. Since then, more information has become available on the L. L. Grace DSP-12 digital-signal processing unit. Brooks Van Pelt KB2CST of L. L. Grace has announced that the DSP-12, a standalone device, is a high-powered, very high speed communications processor. In its present configuration, it can handle HF, VHF and satellite (PSK) packet, Morse, RTTY, (AMTOR and WEFAX will be available later this year) with over 40 software modems. Unlike typical hardware-intensive modems in use today, the DSP configuration allows modems to be "written" in software. When a new data-communications mode is developed, software can be written and loaded into the system.

The DSP-12 does not require EPROM changes to run new modes. The heart of the unit is the Motorola DSP 56001 chip in conjunction with a V40 microprocessor. It uses a single RS-232 port, operating at speeds between 110 and 19,200 bps for all control, operational and software loading functions. It has three radio ports to alleviate the confusion of wire swapping when changing between bands.

The basic unit is to be priced at $595, operates between 8–15 VDC at 750 mA and can be expanded with a megabyte of RAM for $149, a date/time clock backup for $29 and an eight-channel analog-to-digital telemetry/experimentation option for $49. The A/D addition can provide voice compression with digital storage when software becomes available. L. L. Grace sells a wall-mount power supply for 110 VAC operation for $19. They also manufacture the Kansas City Tracker family of satellite antenna aiming systems (available from AMSAT). For further information on the DSP-12 write to: L. L. Grace Communications Products, Inc., 41 Acadia Drive, Voorhees NJ 08043. Their phone number is (609) 751–1018. ■

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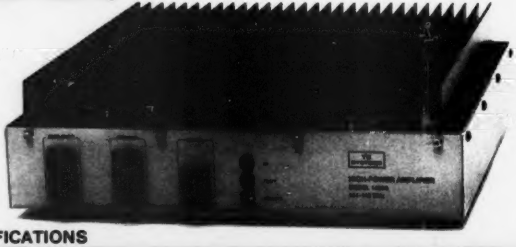

**SPECIFICATIONS**

| | Freq. | Power | | Preamp | | DC | Power | RF |
|---|---|---|---|---|---|---|---|---|
| Model | MHz | Input | Output | NF-dB | Gain-dB | +Vdc | A | Conn. |
| 0550G | 50-54 | 10 | 400 | 6 | 15 | 13.6 | 60 | UHF |
| 0552G | 50-54 | 25 | 400 | 6 | 15 | 13.6 | 55 | UHF |
| 1450G | 144-148 | 10 | 400 | 6 | 15 | 13.6 | 54 | UHF |
| 1452G | 144-148 | 25 | 400 | 6 | 15 | 13.6 | 50 | UHF |
| 2252G | 220-225 | 25 | 220 | 7 | 14 | 13.6 | 36 | UHF |
| 4450G | 420-450 | 10 | 175 | 1.1 | 12 | 13.6 | 34 | N |
| 4452G | 420-450 | 25 | 175 | 1.1 | 12 | 13.6 | 29 | N |

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Models also available without GaAs FET preamp (delete G suffix on model #). All units cover full amateur band – specify 10 MHz bandwidth for 420-450 MHz amplifier. Continuous duty repeater amps also available.

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## HF TRANSCEIVERS

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### KENWOOD TS-440S

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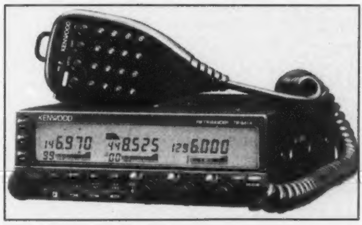
### ICOM IC-726

This portable transceiver offers full ham band coverage from 160 meters all the way up to 6 meters! Explore the exciting world of 6 meter DXing. Receive coverage extends from 30 kHz to 33 MHz as well as 46.2–61.1 MHz, to round out this compact rig. Price class: $1300. Contact *ICOM America, Inc., 2380 116th Ave. N.E., P.O. Box C-90029, Bellevue WA 98009-9029; (206) 454–8155 or (800) 999–9877.* Or circle Reader Service number 202.

## VHF/UHF EQUIPMENT

### KENWOOD TM-941A TRIBAND MOBILE

Why buy three separate rigs when you can have it all with this triband wonder? This new entry into the VHF/UHF mobile market offers high power mobile performance on 144, 450 and 1200 MHz, all in one package. It can even be used as a crossband or triple-band repeater. Price class: $1196. Contact *Kenwood U.S.A., P.O. Box 22745, 2201 E. Dominguez Street, Long Beach CA 90801-5745; (213) 639–4200.*

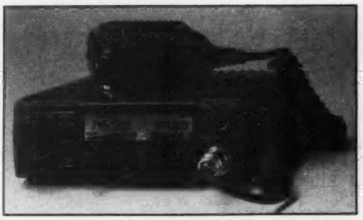


### ALINCO DR-112T 2 METER MOBILE

This mobile rig features an easy-to-use, full-featured control panel. A full 45 watts is available for extended mobile coverage. The back-lit LCD display provides easy viewing for bright or dim lighting conditions. Price class: $320. Contact *Alinco Electronics, Inc., 430 Amapola Ave., Torrance CA 90501; (213) 618–8616, FAX (213) 618–8758.* Or circle Reader Service number 203.

### ICOM 2400A DUAL BANDER MOBILE

This powerful mobile rig offers 45 watts on 2 meters as well as 35 watts on the 70cm band. It simultaneously monitors both bands and can be operated full-duplex. In essence, you get two tranceivers in one! Price class:



$900. Contact *ICOM America, Inc., 2380 116th Ave. N.E., P.O. Box C-90029, Bellevue WA 98009-9029; (206) 454-8155 or (800) 999-9877.* Or circle Reader Service number 204.

### YAESU FT-736R ALL-MODE TRANSCEIVER

Explore the VHF/UHF world with this multimode rig. Operate on 2 meters and 70cm with an optional third band of 50 MHz, 220 MHz or 1.2 GHz. An excellent way to experience the fascinating world of amateur satellite operation! Suggested retail price: $1922. Contact *Yaesu USA, 17210 Edwards Road, Cerritos CA 90701; (213) 404-2700.* Or circle Reader Service number 205.

## HTs

### KENWOOD TH-27A

Kenwood's newest entry into the HT fray. This full-featured mini-HT has a built-in 700 mAh battery pack. Destined to become one the most popular HTs of the '90s. Word has it that Santa uses the TH-27A to communicate with the North Pole from the sleigh. Price class: $420. For more information contact *Kenwood U.S.A., P.O. Box 22745, 2201 E. Dominguez Street, Long Beach CA 90801-5745; (213) 639-4200.*

### YAESU FT-411E

This compact HT adds new features to the popular FT-411. One-touch instant favorite channel recall, built-in PL encoder/decoder and a 10-memory auto-dialer are among some of the unique features of this rig. Suggested retail price: $406. Contact *Yaesu USA, 17210 Edwards Road, Cerritos CA 90701; (213) 404-2700.* Or circle Reader Service number 206.

### ICOM 24AT DUAL-BANDER

This handheld is one of the smallest dual-band HTs you'll find on the market. This lightweight package is capable of crossband full duplex operation. Price class: $630. Contact *ICOM America, Inc., 2380 116th Ave. N.E., P.O. Box C-90029, Bellevue WA 98009-9029; (206) 454-8155 or (800) 999-9877.* Or circle Reader Service number 207.

### ALINCO DJ560T

Features normally found on a mobile rig enhance this compact dual-band HT. Alinco's latest HT entry is sure to be a big hit. For prices and more information contact *Alinco Electronics, Inc., 430 Amapola Ave., Torrance CA 90501; (213) 618-8616, FAX (213) 618-8758.* Or circle Reader Service number 208.

## ANTENNAS AND ACCESSORIES

### ALABAMA AMATEUR ELECTRONICS

This easily-assembled series of VHF and UHF quads is sure to be a hit whenever a quick portable installation is needed. The perfect choice for foxhunting. For prices and more information contact *Alabama Amateur Electronics, 3164 Cahaba Heights Road, Birmingham AL 35243; (205) 967-6122.* Or circle Reader Service number 209.

### OUTBACKER

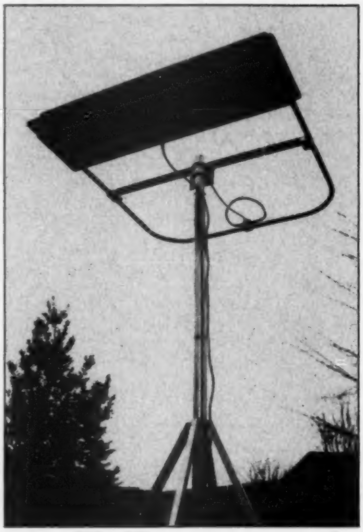
Developed in the Australian outback, these rugged mobile HF antennas really pack a punch. The unique design allows coverage of all HF bands from 75 meters to 10 meters with a simple jack arrangement. They come in decorator colors of your choice! For prices and more information contact *Outbacker Antenna Sales, 330 Cedar Glen Circle, Chattanooga TN 37412; (615) 899-3390.* Or circle Reader Service number 210.

### LIGHTNING BOLT HF QUAD

Discover the many advantages of the HF quad. The strong Fiberglas™ arms can handle a lot of abuse by Mother Nature, and give you that extra DX edge. For prices and more information contact *Lightning Bolt, RD#2, Route 19, Volant PA 16156; (412) 530-7396.* Or circle Reader Service number 211.

### AEA ISOLOOP

For the apartment-bound ham or for a quick portable HF antenna which takes up very little space, the Isoloop is your answer! Now you can work the world from an antenna that can just about fit into any limited space. Price class: $350. For more information contact *Advanced Electronic Applications, Inc., P.O. Box 2160, 2006-196th Street, Lynnwood WA 98036-0918; (206) 775-7373.* Or circle Reader Service number 212.



### BUTTERNUT BUTTERFLY MINIBEAM

This small beam performs like a full-sized antenna. Operates on all bands from 20 through 10 meters without lossy traps. Price class: $333. Contact *Butternut Electronics Co., 405 East Market, Lockhart TX 78644; (512) 398-7117.* Or circle Reader Service number 213.

### GLEN MARTIN HAZER SYSTEM AND TOWERS

Why climb your tower when you can bring your antenna down to your level? The Hazer system allows you to easily work on your system from the convenience and safety of solid ground! For prices and more information contact *Glen Martin Engineering, Inc., Rte. 3, Box 322, Boonville MO 65223; (816) 882-2734.* Or circle Reader Service number 214.

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### SPI-RO MANUFACTURING, INC.

A fine lineup of multiband trap antennas, dipoles and baluns. For prices and more information contact *Spi-ro Manufacturing, Inc., P.O. Box 5500, Dept. 105, Lakeland FL 33807; (813) 646-7925.* Or circle Reader Service number 216.

### MFJ 962C 1500 WATT TUNER

The perfect match to keep your linear happy. The cross-needle SWR/wattmeter allows for easy matching to just about any antenna. Price class: $230. Contact *MFJ Enterprises, Inc., P.O. Box 494, Mississippi State MS 39762; Phone (601) 323-5869 or (800) 647-1800; FAX (601) 323-6551; Telex 53 4590 MFJSTKV.* Or circle Reader Service number 217.

### GAP VI ALL-BAND VERTICAL

Launch your RF into space with this unique all-band vertical that requires no tuning. Price class: $220. Contact *GAP Antenna Products, 6010 Bldg. J, N. Old Dixie Highway, Vero Beach FL 32967; (407) 778-3728.* Or circle Reader Service number 218.

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### DOWN EAST MICROWAVE LOOP YAGIS

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The Hustler quick-release mobile mount allows for easy removal and mounting of your mobile mast. Price class: $20. A complete lineup of mobile antennas is available as well. For more information contact *Hustler, One Newtronics Place, Mineral Wells TX 76067; (817) 325-1386.* Or circle Reader Service number 226.

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### IRELAND TUNE-TENNA HT ANTENNA

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This flexible meter not only measures inductance and capacitance, it operates as a complete multimeter as well! Price class: $130. Contact *Alfa Electronics, P.O. Box 8089, Princeton NJ 08543. (800) 526-ALFA.* Or circle Reader Service number 233.

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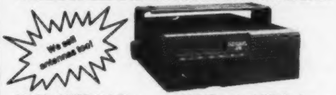

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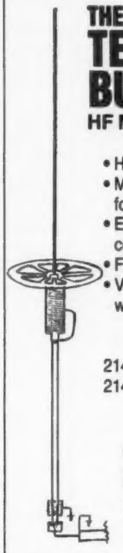

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# HOMING IN

## Radio Direction Finding

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### Hunting For PELTS

Transmitter hunting enthusiasts agree that Radio Direction Finding is unsurpassed as an exciting sport. But just like other aspects of ham radio, it also has the potential for public service. Last time, I told how hams in Utah and elsewhere use their RDFing skills to help agencies such as the Civil Air Patrol find downed aircraft in wilderness areas.

A well-tuned system is now in place for detecting and tracking the signals from Emergency Locator Transmitters (ELTs). When a plane makes a hard impact, its ELT activates, putting out 100 milliwatts on 121.5 and 243 MHz (see the photo). Emergency Position Indicating Radio Beacons (EPIRBs) are similar units for boaters in distress.

Passing aircraft, mountaintop receivers, and orbiting satellites provide first detection of ELT and EPIRB signals. Then they are tracked by Search and Rescue (SAR) volunteers and professionals using airborne, marine, vehicle-mounted, and hand-carried RDF sets.

The National Park Service reports that there were 2900 SAR incidents in 1988. Only a small fraction were for downed aircraft. Most involved lost or injured individuals. Certainly the search for an overdue backpacker or avalanche victim would be enhanced if he or she were carrying some sort of beacon transmitter.

#### Misuse of ELTs

A growing number of hikers and campers are carrying ELT-type beacons with them when they go into the wilderness. Skiers and climbers have gotten interested in them, too. They figure that if they get into trouble, they will be able to take advantage of the massive SAR RDF system already in place.

That's bad news, because today's ELT detection and tracking system was never intended to serve the needs of the 8 million people who take to the outdoors each year. The present ELT system is simply not capable of handling the SAR needs of both pilots and hikers. Using an ELT for anything except aircraft and boating emergencies is illegal, and those who do risk a $10,000 fine.

Already, the false alarm problem with aircraft ELTs is acute. Inadvertently activated ELTs sometimes cover up the signals from actual crashes. One source estimates that two million dollars is spent every year just to track down and shut off the ELTs turned on by bumpy landings and operator error. Increasing ELT usership will only worsen the problem.

One ham thinks he has a better idea. Communications engineer Kenneth Seymour KA7OSM of Beaverton, Oregon, envisions a separate low-cost beacon service for users of the wilderness. He began discussing his ideas with FCC engineers last year. They were enthusiastic because of the growing problem of unauthorized use of aircraft ELTs. The FCC urged Ken to submit a Request for Rulemaking (RM), which he did.

KA7OSM's proposed system was very simple. The technology would be similar to that presently in use for animal tracking and research. Only one or two frequencies would be needed. Transmitters would be low powered and pulsed at a low rate to conserve battery life and to allow multiple transmitters to be tracked simultaneously. Range would typically be one mile.

In addition to wilderness use, the proposal suggested the new service could help parents find lost children in shopping malls and enable police to recover stolen property. Ruggedized transmitters could cost less than fifty dollars. Hand-held RDF sets, including receiver and antenna, would sell for about $150 when mass produced. Voice modes were not included in Ken's service, to prevent its use for bugging.

Discussions with FCC engineers pointed to the 70 MHz region as an optimum RDF frequency range, so KA7OSM suggested that the new beacons be put on the model radio control (R/C) frequencies there.

The FCC promptly assigned number RM-6681 to Ken's proposal. The Academy of Model Aeronautics immediately objected because members did not want their R/C frequencies used. But very few others commented at that time. Last December, the FCC pressed ahead and issued Notice of Proposed Rule Making (NPRM) PR Docket 89-599 to create the Personal Emergency Locator Transmitter Service (PELTS).

#### The FCC Wants More

Of course, the FCC had its own idea about what PELTS should be like. Rather than embracing KA7OSM's simple system, the FCC wanted two-way voice communications in addition to RDF, saying it was important to reassure victims and assess injuries. High power base stations would be put up by state/local governments, rescue groups, and ski lift operators to talk to the portables. Individuals could own portables, but not base stations.

The FCC proposed 10 frequencies. Only one would be for emergency and homing use. The remainder would be for base-to-portable and portable-to-portable voice communications. Bases would be individually licensed, while portables would operate under a blanket base station license.

The requirement for 10 channels, some of them running high power, eliminated the possibility of using the 70 MHz R/C band. The FCC proposed putting PELTS channels at about 220.9 and 221.9 MHz, frequencies that are to be yanked from the Amateur Radio Service by Docket 87-14. That docket had set 220–222 MHz aside for Amplitude Compandored Single Sideband (ACSSB), a new narrowband technology. PELTS would use ACSSB modulation, with the channels spaced only 5 kHz apart.

The period for comments and reply comments on the PELTS NPRM ended in April. Support for the FCC's proposal has been hard to find. Many users of the outdoors want no part of it. They prefer to keep using the ELT frequencies, despite the FCC's declaration that this ". . . could render the existing aviation and maritime distress and safety system ineffective."

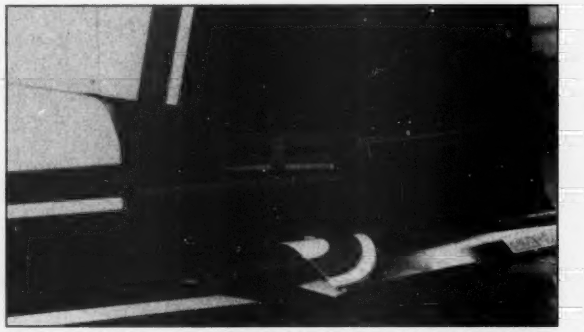
KA7OSM isn't happy with the FCC's version of his proposal. He says it's too complex and hard to implement. The requirement for 10-channel ACSSB radios will add greatly to user cost, as will the need to establish and support a network of base stations.

United Parcel Service does not like the PELTS proposal, either. According to Ken, UPS wants the entire 220–222 MHz segment for its exclusive use.

#### Et Tu, ARRL?

The ARRL filed against PELTS, too. The primary reason, of course, is that the matter of 220–222 MHz reallocation is not closed, and is moving into the courts. True enough, but the ARRL went further, claiming that rules compliance would probably be poor, and that PELTS is impractical because most receivers and scanners presently do not cover the proposed frequencies.

Well, that makes about as much sense as someone saying 20 years ago that cellular phones would never be popular because nobody had receivers for them. Just as cellular technology did then, PELTS will open a new market, and equipment suppliers will appear quickly. There is no need to restrict PELTS to popular scanner frequencies.



*ELTs are designed for mounting in the tail of a plane, like this one, but increasing numbers of hikers and campers are carrying them. (Photo by WB6UZZ.)*

I agree that 220 MHz is not the right place for PELTS, but for a different reason. On-foot RDF in hills and mountains becomes much more difficult as frequency increases. Compared to VHF, reflections are far more pronounced at UHF; just ask anyone who has hunted on 220 or 450 MHz. Multipath slows down the RDF effort, which is certainly undesirable when lives are at stake. Multipath is severe enough on 121.5 MHz, but it is even worse at 220 MHz.

KA7OSM's proposal would have put PELTS at 70 MHz, which is a good compromise. That frequency range is low enough to avoid severe multipath from most terrain features. Lower frequencies would not be practical, because efficient transmitting antennas would get quite long, and sensitive RDF antennas would become too large for easy on-foot use.

#### Round Two

What will happen to PELTS? KA7OSM thinks that the FCC will re-issue the NPRM with significant changes. PELTS could become simpler, as Ken hopes, or more complex, perhaps involving satellite technology.

The biggest problem facing PELTS, or any other new service idea, is finding a place in the crowded spectrum to put it. Here are my thoughts: Let's get back to basics and make PELTS an emergency beacon system for wilderness RDF and rescue only. People who want voice communications in the boonies have plenty of other options, including CB, ham radio, 49 MHz, and itinerant VHF business channels. Without voice provisions, the potential for PELTS rules non-compliance is greatly decreased.

Eliminating the voice communications aspect of PELTS would make it simple and affordable for every hiker. Only one low power frequency would be needed. It should be selected for optimum RDF characteristics. The PELTS beacon frequency could be shared with a wideband service, such as TV broadcast.

I can hear you say, "Sharing with TV is impossible!" But, it is being done right now. Large numbers of flea-power wildlife tracking and telemetry transmitters are beeping away as you read this, on frequencies ranging from 27 to 500 MHz. Biomedical telemetry from hospital patients is being transmitted at this moment from 174 to 216 MHz, which comprise TV channels 7 through 13. Many sound systems have wireless mikes there, too.

There is no unwanted QRM from these bio-emitters. Transmitter power is so low that no herringbone appears in anyone's picture. Wildlife RDF is successful because there is little television signal energy in the DF set's narrow passband, if the selected frequency is kept away from the TV video, audio, and color subcarriers.

How about a tiny piece of channel 5 (76 to 82 MHz)? Even if by some quirk there were a bit of TVI, it would only be at very short range, and would draw attention to the need for a rescue.

A dedicated rescue beacon system for users of the outdoors is sorely needed. Docket 89-599 cited the request of an international SAR council for the FCC to deal quickly with the problem of the public's demand for personal locating beacons. The longer the delay in establishing a service like PELTS, the more people will use aircraft ELTs inappropriately.

Both ELT and PELTS offer opportunities for hams interested in RDF to get involved in public service. "Homing In" will be watching for new developments. Let me know your thoughts. 73

Number 27 on your Feedback card

# RTTY LOOP

## Amateur Radio Teletype

*Marc I. Leavey, M.D., WA3AJR*
*6 Jenny Lane*
*Baltimore MD 21208*

### Remember PICON?

As this column is being written, in late August, the newspaper, TV, and radio are filled with daily reports of the unfolding crisis in the Middle East. To the average citizen, these media represent the only source of information about world events. But for the amateur, a far more lucid view is afforded by some digging around the airwaves.

While many amateurs tune in to the various state-run radio broadcasting services from the region, to get an "on site" view, those of us who are digitalized (apologies to fellow physicians for that one) can listen in as well to the many non-voice services carrying information.

Along with providing a personal window into the action, the informed amateur can often garner some publicity for the hobby by letting a local newspaper or TV station know about his or her access to information. Here in Baltimore, several amateurs have been featured in the media with just such a premise.

In these days when we are bemoaning the apathy and attrition afflicting amateur radio, anything we can do to raise the public consciousness towards the valuable services this hobby of ours can provide can't help but attract newcomers. And, for those of you who can't remember, or never learned, the above acronym, that's the Public Interest, Convenience, Or Necessity—the premise under which amateur radio operates!

### Clouded Windows

I recently purchased a new computer, one which leaves my old Turbo-88 style machine in the dust. Included with the machine were both DOS and Windows 3.0. Well, kind of.

After unpacking and setting up the machine, a computer magazine arrived with a review article on Windows, which indicated that integral with the new Windows package was a program called Toolbox, which enabled the construction of Windows applications. One such application, Daybook, was also included. Well, search as I might, I could find no such program on my disks.

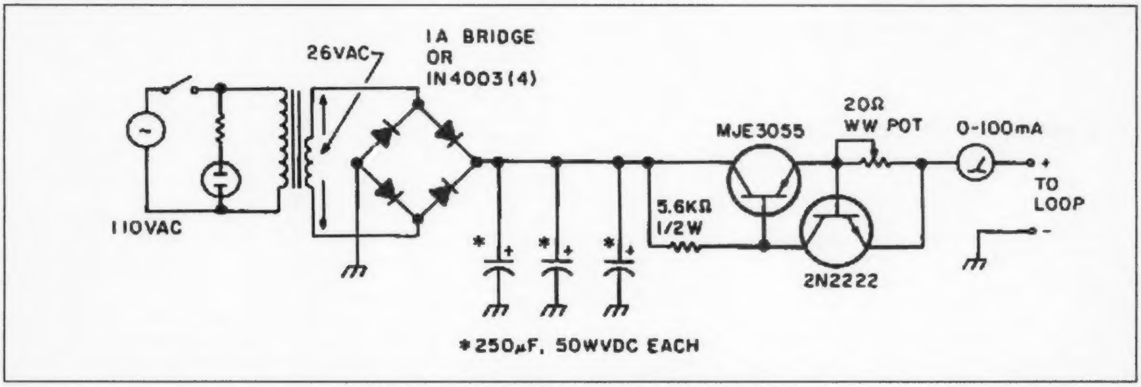
So, being the good soul, I called the computer manufacturer, Gateway 2000, and asked about the missing program. At first I was assured that the Windows package included with the computer was complete, that no programs were omitted. When I pursued the point, I finally reached a salesman who confirmed that Toolbox was not included with the Windows package bundled with Gateway 2000 computers.

He added that this was a shock to him, as he apparently had the Toolbox package on his desktop computer, and was under the impression that the Windows he sold was the same as the Windows he used. It's not. A bit more research turned up the information that this omission may not be unique to Gateway 2000. It seems that each vendor may negotiate the contents of the Windows package bundled with its system. I have no information on DOS, but this may also be more fluid than one might think. So, we return to the venerable principle, caveat emptor, let the buyer beware. Before buying a computer system with bundled Windows or DOS, ask just what that package contains.

### Loop de loop

I received an inquiry recently about, you'll pardon the expression, a RTTY loop supply. It seems that some of you are building or using a solid state interface which is, itself, loopless!

Well, fret no longer. See the figure for the solution.



*Loopless? Try this low voltage, current-limited output supply.*

This is a straightforward supply, which features a low voltage, current-limited output fully capable of powering an old Model 15 teleprinter. It keeps the voltage low enough to prevent frying those silicon chips that are overtaking our shacks.

The parts for this little darling should be easy enough to obtain, either from the electronics emporium in your local mall (there *is* one of those "RS" [Radio Shack] stores near you, isn't there?), or from any of a number of mail order firms. If you really want to build something, this or any project, and still can't find a source, let me know, and we'll devote some space to it.

Meanwhile, I look forward to your comments, suggestions, questions, contributions, and critiques. Send them to me at the above address, or by way of Email on CompuServe (ppn 75036,2501) or Delphi (username MARCWA3AJR). Believe me, I look forward to reading every one of them!

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# SPECIAL EVENTS

## Ham Doings Around the World

*Listings are free of charge as space permits. Please send us your Special Event two months in advance of the issue you want it to appear in. For example, if you want it to appear in the January issue, we should receive it by October 31. Please provide a clear, concise summary of the essential details about your Special Event. If your announcement arrives here too late to be included in the magazine, it will be entered in the /HAMFESTS SIG on our BBS, (603) 525–4438. 8,0,1.*

### NOV 3

**KAUKAUNA, WI** The Fox Cities ARC will hold their Hamfest at the Starlite Club on Rte. 1. Check-in for testing at 8:15 AM. Testing at 9 AM. Table reservation address: *Don Baker, 621 W. 7th St., Kaukauna WI 54130.* For info call *(414) 766–3886.*

### NOV 10

**WEST MONROE, LA** The Twin City Hams Hamfest will be held at the West Monroe Convention Center from 9 AM–3 PM. Free swap tables and Flea Market. Free parking. Handicap facilities. VE Exams. Talk-in on 146.25/.85. Contact *Benson Scott AE5V, 745 40 Oaks Farm Road, West Monroe LA 71291-9432. (318) 323–3478.*

**MILWAUKEE, WI** The Milwaukee Repeater Club will sponsor the 6th annual 6.91 Friendly Fest at Serb Hall from 8 AM–1 PM. Sellers start at 7 AM. Tickets $4. 4′ tables $5. License Exams. Talk-in on 146.91 and 146.52. To save $1 per ticket or table send SASE with payment to *The Milwaukee Repeater Club, PO Box 2123, Milwaukee WI 53201,* before Nov. 3rd.

### NOV 11

**ALLAIRE, NJ** The Garden State ARC, Jersey Shore ARC, Neptune ARC and Ocean-Monmouth ARC will sponsor a Hamfest at the Allaire Expo Center, Allaire Airport from 8 AM–3 PM. Vendors 6 AM. Tailgating, VE Exams, Ham Radio & Computer demos. Fly-in frequency: 123.0 unicom. Talk-in on 145.110 −600, KC2Q/R. 146.520 simplex. Admission $4 advance, $5 at the door. Children under 12 and XYL free. Tables $20. Tailgate $8. Contact *Al Jackson NK2O, PO Box 635, Eatontown NJ 07724. (201) 922–8121.*

**MASSILLON, OH** The Massillon ARC will sponsor "Auctionfest '90" at the Massillon K of C Hall on Cherry Road from 8 AM–5 PM. Sellers set-up at 7 AM. Free parking. Advance admission $3.50, $4 at the door. Tables $7 per 8′ space. Auction starts at 11 AM. Talk-in on W8NP, 147.78/.18. Send SASE with payment to: *MARC, PO Box 73, Massillon OH 44648.*

**NORTH HAVEN, CT** The SCARA indoor Ham Radio/Computer Flea Market will be held at the North Haven Park and Recreation Center from 9 AM–3 PM. Tables $15 advance, $20 at the door. General admission $3 per person. Talk-in 146.01/.61. Reservations for tables must be received with check by Nov 1 and no reservations by phone. For info/reservations, SASE to: *SCARA Flea Market, PO Box 81, North Haven CT 06473* or call *Brad at (203) 265–6478* between 7 PM–9 PM.

### NOV 16

**VERONA, NY** The Madison-Oneida ARC holds VE Exams the third Friday of every month at the Madison-Oneida BOCES on Spring Rd., beginning at 7 PM. W5YI-VEC affiliated. Contact *Leonard Popyack WF2V. Phone (315) 853–8974, or on 146.79, 145.37, WF2V @ WA2TVE, or POPYACK@TOPS20.RADC.AF.MIL.*

### NOV 17

**BILLERICA, MA** The Bull HN 1200 Radio Club, and the Waltham ARA, will sponsor their annual Amateur Radio/Electronics Auction at the Bull HN plant, 300 Concord Rd. Doors open at 10 AM. Free admission and parking. Talk in on 146.04/.64 and 147.72/.12 repeaters. For info contact *Mike Rioux NW1J, 132 Killam Hill Rd., Boxford MA 01921.*

### NOV 17–18

**FT WAYNE, IN** The Allen County Amateur Radio and Technical Society will hold their 18th annual Ft. Wayne Hamfest at the Allen County War Memorial Coliseum Exposition Center from 8 AM–5 PM Sat. and 8 AM–3 PM Sun. Set-up Fri. 5:30–9:30 PM, Sat. 5–7 AM. VE Exams. Admission $5 advance, $5.50 at the door. Reserved tables $30 premium, $15 regular, power $25 extra. Talk-in on 146.88– and 443.80+. Send SASE to *ACARTS, PO Box 10342, Ft. Wayne IN 46851 for tickets and tables. (219) 693–3766* (evenings).

**TAMPA, FL** The 15th Annual ARRL Suncoast Amateur Radio/Computer Convention, sponsored by the Florida Gulf Coast AR Council, will be held at the Curtis Hixon Convention Center on Ashley Street. Hotel reservations may be made at the Ramada Airport Hotel by calling *1–800–228–2828* before Nov. 6th. (Mention the Suncoast Convention for the convention rate.) For info call *(813) 854–1105 or (813) 442–3830.*

## SPECIAL EVENT STATIONS

### OCT 31–NOV 1

**BREVARD, NC** The Transylvania County ARC will operate K4AIF to celebrate Halloween from the Devil's Courthouse in Transylvania County from 2100Z Oct. 31–0200Z Nov. 1. Frequencies: SSB—3.860, 14.295, 50.150; Simplex—146.52 FM. For certificate, send a legal size or 9 x 12 SASE to: *Dick Gustafson K4AIF, 302 Wilson Dr., Brevard NC 28712.*

### NOV 8

**CLINTON, NC** Sampson County ARS will operate AB4TT from 1700Z–2400Z in conjunction with the Sampson County Expo and Pork Festival. Operation in lower portion of General bands plus ten meters; 28.100–28.500. QSL via: *SCARS, PO Box 64, Clinton NC 28328.*

### NOV 10

**VIC AUSTRALIA** Australian Ladies' Amateur Radio Assoc. Contest starts at 0001 UTC and ends at 2359 UTC. Bands: 3.5, 7, 14, 21, and 28 MHz only. Frequencies: 28.380–28.410, 21.190–21.200/.380–21.410, 14.250–14.280, 7.070–7.100, 3.560–3.590. Operation: Phone and CW. Each station counted twice on each band for credit; once on phone, once on CW. All contacts must be in accordance with license regulations. No net or list operation, no crossmode. Procedure: Phone–call "CQ ALARA CONTEST," CW–YLs call "CQ TEST ALARA," OMs call "CQ YL." Exchanges: ALARA member: RS or RST, serial No. starting at 001, ALARA member, name. YL non-member: RS or RST, serial No. starting at 001, or OM name. Scoring: Phone: 5 points/ALARA member contacted, 4 points/YL non-member contacted, 3 points/OM contacted. CW: contacts where at least 1 operator is Novice class count double points. SWL: 5 points/ALARA member logged, 4 points/YL non-member logged. Logs must show date/time UTC, band, mode, callsign worked, report & serial No. sent, report & serial No. received, name of operator of station worked, and points claimed. Also show full name, callsign, address and signature of operator. No carbon copies. No logs will be returned. Australian YL Novices entering for the Mrs. Florence McKenzie CW trophy should indicate their CW score separately. Logs must be received by Contest Manager *Mrs. Marilyn Syme VK3DMS, PO Box 91, Irymple. 3498, Vic. Australia,* before the Dec. 31st deadline.

### NOV 10–11

**WASHINGTON, DC** HAMVETS will operate N3EKX near the Vietnam Veterans Memorial to commemorate Veterans Day. Operation will be on 20, 40, 75 meters in the General portion of the bands. For picture QSL, send QSL and SASE to *K9ICF, 13300 Wye Oak Dr., Darnestown MD 20878.*

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# DX

*Continued from page 52*

always seemed that the AC line voltage was low. However, I never actually measured it. Also, I often felt that I was copying stations longer than they heard me. I have no doubt that a small linear would have helped. Incidentally, with the usual DXpedition approach of "you are 59," it is easy to be lulled into believing these signal strengths. Often signals did not move the S meter—"You're 59—QSL?" Often the signal was S4 or S5—"You're 59—QSL?" I worked five bands—80 through 10 meters. I stayed away from the WARC bands because I didn't want to rock the boat. I could certainly claim 80–10 meters as exclusively radio amateur (more of less), but I did not want to cause any problems with possible QRM on other bands—perhaps not even recognized. Still, I had the usual requests: "When will you be on 10, 18, 24 MHz?", "Will you be on FM on 29 MHz?", etc.

One of the thrills of getting on RTTY was that, as far as I have been able to find out, the Kingdom of Bhutan has never been available on this mode. It was strange, but this mode really fascinated my friends. I think the screen readout had something to do with it. I demonstrated keyboard Morse, automatic Morse readout, random Morse generation, and so on. It was a huge success. The first ever RTTY QSO took place between Gin JA1ACB, and A51JS on the second day of operation. Again, judging by the pile up, it was a popular mode with hams in general. A beam would have helped—the pile-up QRM was tremendous. I would be inclined to use FSK in any future operation or pick up some receiver selectivity—the SSB filter is much too wide when using AFSK.

Finally, back in the relative cold of Thimphu, I was soon wrapped up once again in my regulation clothes (two pairs of socks, vest, shirt, pullover and parka). In the room there was a small blower type heater of about 1 kW rating, with the lowish voltage I reckoned on about 800 watts. It helped, but!!!

I met Pradhan A51PN on several occasions and we got on very well. I was sorry that he was not able to operate as A51PN immediately, but there were a couple of formalities to complete. In any case, I left an ICOM 740, my trusty Butternut HF6V, a microphone, an AT200 antenna tuner, and some coax cable. In various discussions I had mentioned that I would like to meet Yonten, ex-AC5TY. This was arranged and, despite being a very busy government official, Yonten gave me a very warm welcome. We had a courteous meeting in his office and we talked about old times, his travels and activities as AC5TY.

I was very lucky in that Sherab, in his capacity as Deputy Chief Engineer, showed me around several of the Bhutan Wireless Stations. There is an extensive network in the Kingdom. A great deal of the traffic is CW so all of the operators (including Sherab) are very proficient in Morse. The equipment was usually driven by batteries (with charger) and operated on a multichannel SSB/CW link. All circuits were very busy.

I also attended one of the Morse classes, training new operators. After using a Bencher paddle for so many years, my brass pounding was very rusty. Still, it's like riding a bike (so they say)—once learned, never forgotten. Within a few minutes I could feel my confidence returning. My fist gradually improved to send tolerable Morse. It was all good fun.

On top of this station there was a triband beam—I was tempted to ask if I could borrow it for a week—but it was used on a very busy Indian circuit running just below the CW edge of 20 meters. By all accounts, the circuit was "solid" most of the time. It used an FT-101.

Leaving the HF6V vertical meant that I could use the rig more or less until I was due to leave. There would be no need to QRT the evening before, but Murphy had one final say. The propagation was so terrible that my planned final multi-hour marathon came to nothing. At about 2300 local time I finished packing and my operation as A51JS was over.

Early Wednesday morning we left the Molithang Hotel and Thimphu for Paro Airport. I felt really sad. The Druk Airline plane left on schedule and so it was good-bye to Bhutan after my three-week stay. Once again we were not allowed off the plane in Dhaka and by lunch time I was back in Bangkok for another two-day transit stay.

During this stay in Bangkok I arranged to get all my excess baggage through as unaccompanied baggage, a much cheaper solution. In Bangkok I had a very strange feeling that it had all been a dream. Had anyone really worked A51JS? Had I really been in Bhutan?

Back at home on Saturday afternoon my mind was set at rest. The inevitable pile of mail awaited my arrival, and a great deal of it was for A51JS.

I would like to thank many people, but if I thank Sherab Dorji maybe that will be enough. Without his continued efforts on my behalf (and, for that matter, on behalf of amateur radio in the Kingdom of Bhutan) A51JS would never have become reality. To the members of the H.I.DX.A. Club, to all my fellow DXers who helped, and to the RSGB and the ARRL—sincere thanks. All acknowledgments of assistance appear on the A51JS QSL card.

Tashi Dalek (may your journey be a safe one). 73, Jim VK9NS.

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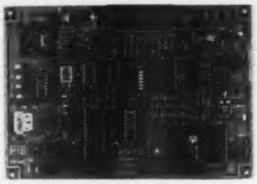

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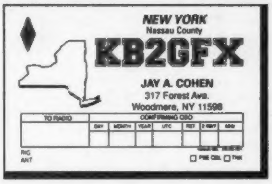
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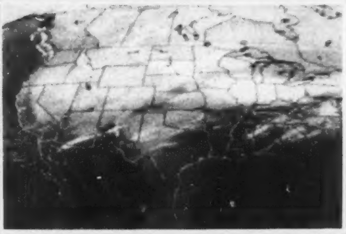

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The *73 Flea Market*, Barter 'n' Buy, costs you peanuts (almost)—comes to 35¢ a word for individual (noncommercial) ads and $1.00 a word for commercial ads. Don't plan on telling a long story. Use abbreviations, cram it in. But be honest. There are plenty of hams who love to fix things, so if it doesn't work, say so.

Make your list, count the words, including your call, address and phone number. Include a check or your credit card number and expiration. If you're placing a commercial ad, include an additional phone number, separate from your ad.

This is a monthly magazine, not a daily newspaper, so figure a couple months before the action starts; then be prepared. If you get too many calls, you priced it low. If you don't get many calls, too high.

So get busy. Blow the dust off, check everything out, make sure it still works right and maybe you can help make a ham newcomer or retired old timer happy with that rig you're not using now. Or you might get busy on your computer and put together a list of small gear/parts to send to those interested?

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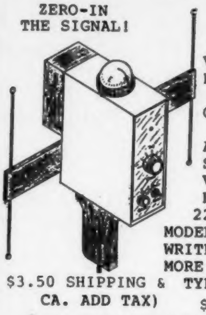

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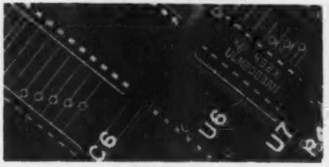

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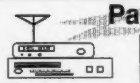

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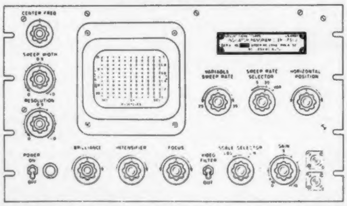

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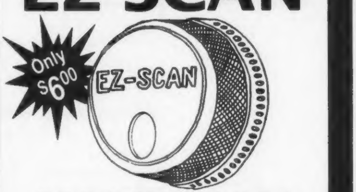

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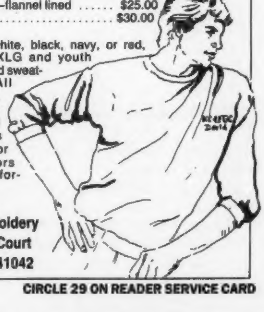

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# *Never Say Die*

*Continued from page 4*

much too late. If the League has been doing their WARC-'92 homework I'm not aware of it . . . and I, unlike reasonable men, read those boring board minutes in *QST*, which is certainly where I should find out what, if anything, is being done.

Yes, if I generously donate to the cause, I expect I'd help pay to provide some ARRL directors (and their families) with a great vacation. I'd probably also be paying their salaries while they're away from work. Would my generosity help them stay in the world's most expensive hotels instead of the places I would go?

Yes, I know it was unreasonable, but somehow I managed to fight off the urge to answer their call for money.

**A Club Opportunity**

You've been reading my editorials on killer electric blankets and water beds. You've been reading the same news in almost every news magazine, so you may by now almost about have begun to suspect that I did my homework before writing.

We've shown you how to build a milligaussmeter to check homes for safe 60 Hz field strengths. Now, has your ham club bought or built a gaussmeter and gotten publicity in your local papers and over local radio (and TV) stations, offering to gauss out homes for people who are wondering if they are exposing themselves and their children to dangerous low frequency fields?

What a great opportunity to get publicity for your club, and to provide a desperately needed community service. Or is your club made up entirely of reasonable men who are incapable of imagination and frozen by inertia? Your club could easily save dozens to hundreds of lives and have a ball while doing it.

Yes, the local power company will probably fight you tooth and nail, poohpoohing the whole exercise. Remember how the tobacco companies bought scientists to explain that there really was no absolute proof that cigarettes kill you? The power companies have invested in the best scientists their money can buy and they are singing the same tired song. But I'll bet none of the power company people, their lawyers or their scientists are using electric blankets any more.

How many children can you save from leukemia? How many people from deadly brain tumors? I'll be watching the club newsletters to see what your club is doing. I haven't seen one peep yet in any newsletter. Darn, there I go being unreasonable again!

But this is just one example. With some imagination your club could get into the papers several times a year. There's always something newsworthy going on, once you get thinking in those terms. Some clubs make a big deal out of Field Day and get a whole page in the newspapers, plus a few minutes in the evening news. That's solid gold selling of our hobby.

Yes, sigh, someone has to do the, sigh, work of writing the news releases, calling the editors, and organizing the promotion. No reasonable man would volunteer for that. Heck, no one with any sense (reasonable) volunteers for anything. Let someone else do it . . . I think I'll have a beer.

**De-Blathering**

It was RTTY that got me into this whole publishing mess 40 years ago. Well, there was one aspect of RTTY that was really great. Without that, I don't know if I'd have gotten hooked so thoroughly.

Let me be blunt. Even 50 years ago, in 1940, most ham contacts were routine and boring. It's incredible how little that down side of amateur radio has changed in 50 . . . probably 70 years. But RTTY, in addition to being a substantial technical achievement, provided two additional bonuses.

First, since it required a lot of building and a good deal of effort to get the equipment and get it running, the chaps who managed that hurdle weren't average hams. I found most of them very interesting to contact.

> ***"Kids today aren't exaggerating when they say they don't have time for ham radio."***

Second, most of us put in punched tape systems for automatic transmissions. This meant that I could put together rather extended pieces on interesting subjects without the pressure of knowing someone was waiting on the other end for me to get through typing. I'd write and punch the stuff into tape at my leisure. Then, during a contact, when something came up which was covered by a punched tape, I'd reach up and pull the tape off a hook and feed it into the tape transmitter and it would zip through at 60 wpm. Since I had a wide variety of interests, I had lots of punched tapes hanging handy.

Also, if the incoming message looked interesting I could turn on the tape punch and save it for re-transmission to someone else. Remember, this was back before magnetic tape was available. We did have wire recorders, but they weren't easy to use.

During the last 40 years tape recording technology has progressed remarkably. Yet how many hamshacks have a cassette recorder?

I wonder if anyone has thought about making cassettes on topics which might be of interest to the chaps being contacted? It wouldn't be a big deal to have a bunch of five and ten minute cassettes to tell about things of interest.

For instance, I have a cassette which is being sold through gift shops all over New Hampshire. It's called, "How To Speak N'hamsha Like A Native." How I got the idea for this, made it and put it on the market is an interesting story. My skin diving trip to the Caribbean last year was another saga worthy of a few minutes of tape. Or my DXpedition to St. Pierre last year.

If I had these stories on tape, I'd be more likely to run 'em and perhaps provide slightly more interesting contacts. I'm lazy, like almost everyone else, so I tend to not get involved in long stories during my contacts.

Yes, this sort of thing can easily get out of hand . . . and the next thing you know we'd have more ham broadcasting stations sending out "ham bulletins" ten times a day on 14,285 or something.

As anyone knows who's sat through my talks at hamfests, I can go on for hours. And that's without any questions. They trigger even more talk. With only the slightest of encouragement I'll bet I could provide enough talk to keep a 24-hour a day ham broadcast going for weeks.

Do you know that the first trans-Atlantic ham contact was made by a pirate and that no one knows to this day who he was?

Let's see if you can hook your cassette recorder into your rig and keep the RF feedback out. With that technological leap maybe we can organize some more interesting contacts.

Those of you who've been into slowscan have been using your cassette recorders to save pictures from DX contacts . . . and to send your own SSTV programs. Some of these programs are pretty good. Years ago I held an SSTV contest for the best programs and I got dozens of first rate ones.

The next time you're sitting there reciting your name, QTH, and other such trivia for the several thousandth time, give some thought to having a few programmed cassettes at hand to spice up your QSOs.

If you have a computer with a hard disk you can put the info on it, making it even easier to access. And you'd have something to write about, too.

**Thanks, Horace Mann**

When the federal government took over education in America and instituted compulsory schooling, it was with the goal of managing the mass population and producing people whose behavior could be predicted and controlled.

It all started in Massachusetts around 1850, by the way. It took them over 30 years to overcome the public's resistance . . . sometimes with guns. It's perhaps interesting that the literacy rate was 98% before compulsory education and has never gotten above 91% since in Massachusetts. Why, it's almost enough to make someone think!

Under this system our children are separated from other age and social class groups and held captive for some 30 hours a week. They sleep about 56 hours, watch TV 55 hours (national average), spend about eight hours a week getting ready, going and coming home, plus seven hours a week on homework (unless they're Asians), which leaves them around 12 hours of their own . . . or to talk with their families. Is it any wonder we have millions of brainwashed "reasonable" people coming out of this cookie-cutter system?

For some reason I was aware of how bad the system was and I despised it. I didn't see much difference between being a kid and being a slave. I was about 12 when I figured this one out.

The great American people mold works fine . . . for America. It sure stinks for individuals. Our federal school system is a socialist system. It's dictated by the federal government . . . the same system they used to try and run businesses in the USSR and the Eastern Bloc with such disastrous results. The government is unable to handle a planned economy . . . and that includes education as well as transportation, communications and so on. You can't name one business the government has ever been in that it didn't screw up. And that, sadly, includes the government itself. What a mess!

Kids today aren't exaggerating when they say they don't have time for ham radio. Not unless they can get away from TV. Talk about an addictive drug! Millions of women get enormously upset if they miss their soap operas. Even if they're out working they tape 'em. TV is entertaining. It's FREE! . . . particularly if you fast forward through the commercials. Most of it is mental chewing gum.

With TV so entertaining, and with kids being fed it every day from birth on, it's no wonder that they have so little interest in reading and hobbies other than video games. School, which is compulsory, is so dull it destroys their interest in learning. And with schools adjusted to demand a minimum of effort, we have the recipe for today's kids.

In a few schools the teachers have gotten together to fight the system. They've made monumental efforts to get the parents interested in their children's education, and the results have been spectacular. I don't know what's going to happen to the kids when they get into the usual old fashioned garbage compactor high school. Perhaps it'll turn them back into reasonable people.

Progressive schools are starting to encourage after-school clubs again. Teachers are giving the extra time despite the non-union hours involved. If you have an unreasonable ham club president perhaps he can talk with the school principal and arrange to have your club members elmer a school radio club. The time is ripening for this as a few schools try to fight their way out of mediocrity. We hams have a lot to offer. Heck, we might even manage to cut in on the kid's TV watching.

The reasonable approach is the Russian one. (1) It can't be done. (2) I'm tired.

# ATV

Number 32 on your Feedback card

## Ham Television

*Bill Brown WB8ELK*
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### The *73* ATV Balloon

Living near the Atlantic Ocean is great . . . unless you're trying to launch a balloon package and have it land on solid ground! After several weekends of high winds in the jet stream (guaranteed splashdown in the ocean) and bad weather at the launch site, we finally got a winner on July 23rd. It was a perfectly calm day, allowing us to easily inflate the balloon outside. Liftoff occurred at 2:03 p.m. EDT, from the parking lot of *73* headquarters in southwestern New Hampshire. The balloon slowly headed off toward the Nashua/Derry area.

The balloon payload consisted of a 100 milliwatt 2 meter FM transmitter (144.340 MHz) with a Digitalker™ altimeter. The ATV payload consisted of a 1 watt P.C. Electronics KPA5-RC (their new R/C ATV transmitter module) transmitting on 426.25 MHz along with a video ID board with four special graphic screens.

The HF net was operated on 7.155 MHz by net control stations Bob N1EDM and Carl N1FYZ. Bob and Carl did an excellent job running the net and keeping everyone updated on the launch progress. At *73* headquarters, David N1GPH provided a blow-by-blow description of the launch. At least 70 stations from all over the northeast provided continuous reception reports and helped track the balloon's progress across New Hampshire.

#### Ups and Downs

Although the 2 meter signal died at 50,000 feet, strong reception was reported all over New England. The talking altimeter/ID was only partially successful. The ID worked OK but the altimeter section just relayed random numbers. Apparently a wire broke loose on the board.

The ATV signal was received over most of New England at P3 to P5 levels. The balloon signal even brought up the W1NRE ATV repeater in West Haven, Connecticut. The furthest north reception of the ATV signal was reported by VE2BOS in Quebec City, Canada (P1); to the south, W2DTC saw a P2 picture in Red Bank, New Jersey. Mike WA1PTC reported a P5 picture from 60 miles away from his portable station on top of Mt. Agamenticus, Maine.

My computer prediction indicated a possible touchdown just east of Derry, New Hampshire. I told Warren WB1HBB he should get out a large net and try to catch the payload since he lived near Derry. It appeared that the package landed within a mile of his house!

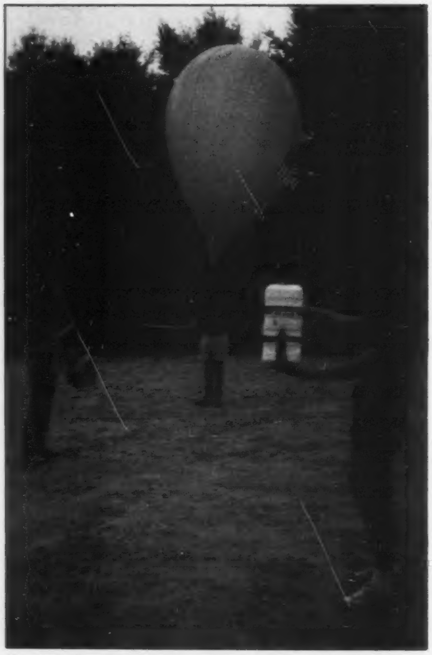

*Photo A. The 73 balloon ready for launch. Left to right: Nuge WB8GLQ, John N1HFE and Mary Cassidy.*

#### Into the Swamp

At least six chase vehicles swarmed into the area looking for the payload. Members of the Interstate Repeater Society (IRS) and hams from across southern New Hamsphire teamed up to track down the balloon. Two of the trackers had a mobile ATV station as well (KA1CRN and WA1PTC). Special thanks go out to Larry KA1CRN, John N1HFE, Arnie N1BAC, and Dave N2GE for their repeated visits to the launch site during the previous scrubbed efforts.

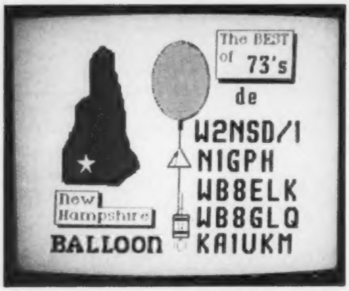

*Photo B. Balloon transmission as received by Mike WA1PTC on Mt. Agamenticus, Maine (60 miles distance).*

Overhearing the chase effort on the Derry repeater, a passing pilot offered to give one of us a ride in his Cessna to help search the area. Lane WA1LCW flew along with a scanner on 426.25 MHz. He acquired a definite signal near a swamp. At one point he shouted, "I see a bright orange parachute-like object in someone's backyard . . . A lot of people are crowded around it!" Bill WA1DMV drove up to the house to investigate. He walked behind the house to observe a dozen folks sitting around a large orange picnic blanket. With an airplane circling above them and Bill walking in on them carrying an HT, I'm sure they thought they were in the middle of a government raid!!

Using the chase plane's best location fix and plotting beam headings from all over the region, we were able to triangulate the balloon payload's position within a mile or two. As near as we can tell, the payload landed in a mosquito-infested swamp near Big Island Pond. The area is filled with bogs and quicksand which made recovery impossible. We hope to search the area again when it freezes over and the killer mosquitos die out!

Since the launch, two low altitude search flights have been made. Lane WA1LCW and Mike WB2WNX did a photo survey of the area four days after the flight. The following day I went on another airplane trip with Rich KB4N and Gene WA1UXA to take another look. Nothing has been seen as yet.

### Stratonet Sky Beacon Success

The first flight of the K4BV Sky Beacon 1 last July was stopped short when the balloon ripped open at 2600 feet. Apparently a small hole developed near the nozzle while they were holding onto the balloon during high winds before launch.

#### Live Camera Flight

After several weeks of redesign, John Bayne N4EEB, Vic Leisner W3LGV and Bill Leisner W2MPU put together a whole new package. Their latest attempt was a success! Launch occurred Sept. 15th at 10:43 a.m. EDT from the Deland airport, about 20 miles west of Daytona Beach. Their new package contained a 1 watt 2 meter FM transmitter which relayed a tone sequence indicating internal and external temperature as well as the altitude. The ATV payload consisted of a Uniden B/W camera mounted in the bottom of the package. A transparency with the callsign written on it was suspended in front of the lens. Talk about a high tech-video overlay! The transmitter operated on 434 MHz using a P.C. Electronics KPA5-RC. The antenna was a dual-band vertical mounted on top of the payload. To conteract the spinning problem encountered on previous balloon flights, a balsa wood weathervane was attached to the package. It apparently worked out very well as excellent views of the Earth below were received over the whole state of Florida clear down to the Keys. The weathervane did its job—the image was very stable during the ascent.

At the highest altitude, the 2 meter signal was heard as far away as Valdez, North Carolina, by W4YIU. Reception of the 2 meter beacon and ATV reception was reported in a good portion of the Southeast.

The HF net operated on 7.155 MHz, with Frank KB4T as net control. The net sounded much like a NASA launch with remote patches directly to the launchsite on 2 meters. In addition, Ernie K4RBD linked the launch preparations and the liftoff back to the K4BV ATV repeater in Daytona Beach. Although the net control station was 20 miles away from the launch site, he could watch the launch activities via the repeater and report it all to the net. Stations in the Daytona Beach area were watching the pre-launch activities as well.

*Photo C. The K4BV Sky Beacon balloon at launch. Deland Airport, Florida. Photo by John Bayne N4EEB.*

After rising for 1 hour and 43 minutes the balloon burst at 94,000 feet. During descent the balsa weathervane broke off, causing the package to spin around at rates approaching 92 RPM!

*Photo D. Ken Vanslette WB4FKL is boosted up to grab Sky Beacon 2 from the tree. Larry Webster N4URS (left) and James Crabtree N4VZL (right) aid in the effort. Photo by John Bayne N4EEB.*

*Photo E. Larry Webster N4URS proudly displays his find! James Crabtree N4VZL (left) radios the news back to the rest of the chase team.*

Vic W3LGV used his SSTV converter to freeze-frame the images which showed the roads and canals during the final stage of descent. He was actually able to find the balloon's location, using a road map of the area to help direct the chase team to the right spot.

**Recovery**

There were six chase teams and two airplanes involved in the tracking and recovery effort. Bill Morse WA4OBY flew alongside the payload in his plane during the first 14,000 feet after takeoff. Bill W4MPU and Bruce KB4GW took off in the second plane during the descent to aid in the search effort. It took about two hours to home in on the signal after landing. As members of the chase team closed in on the landing site they started to receive snow-free images from the payload. They were surprised to see the smiling face of Larry Webster N4URS peering up into the camera lens as the package dangled from a tree limb 25 feet above him.

The final touchdown point was 15 miles east of the launchsite near the town of Samsula (New Smyrna area). According to the tracking crew, the package had headed out to sea for awhile. Fortunately, a few minutes before landing it caught an onshore wind which brought it back to solid ground. It was found just seven miles short of the Atlantic coast. 73

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# ABOVE AND BEYOND

## VHF and Above Operation

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## Questions and Answers

This month I will cover mailbox comments and questions about some of the projects I've presented in this column. Questions always make me dig deeper in the electronics section at the public library. While this can be time-consuming, I enjoy it, as it serves to increase my own understanding of electronics. I do not profess to be an expert, rather an interested observer willing to apply the information to projects for our microwave bands.

### Low-Noise, High Gain MMIC

Our first topic comes from Ron Geisler of Eastlake, Ohio, concerning the noise figure of wideband amplifiers covering hundreds of MHz (see the April 1990 issue). Ron knows that the broadband MAR series of MMIC amplifiers have a noise figure of about 5 dB. He desires information on devices that give a much lower noise figure but keep the broadband frequency coverage to about 1300 MHz.

Well, Ron, in *73 Magazine*, Electron Processing advertises a preamp good from 1 MHz to 1300 MHz, with a 2.8 dB noise figure, for $70–$100 (with remote mounting option). For more information, you can write Electron Processing at P.O. Box 708, Medford NY 11763, or call them at (616) 228-7020.

Home construction is another alternative. Using a special MMIC amplifier, you can build a preamp with the desired specifications. The Avantek INA-02170, for example, boasts 31.5 dB gain at 500 MHz with a 2 dB noise figure, and 25 dB gain at 1.5 GHz with a 2.8 dB noise figure. The INA-02170 is one in a series of Avantek MMICs that are fabricated from Avantek's 10 GHz ISOSAT™ silicon bipolar process. It is packaged in a high reliability, hermetic, gold ceramic mounted package for applications meeting industrial and military specifications.

The device is used much the same as a standard MMIC amplifier of the MAR series. The difference is the high gain and high output power (+11 dB) coupled with the very low broadband noise figure possible with this device. See Figure 1 for typical application data.

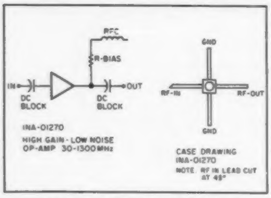

*Figure 1. INA-02170 Amplifier.*

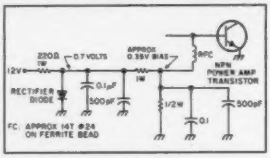

*Figure 2. DC bias circuit for power transistor amplifiers (SSB operation).*

Now the bad news. Compared to a standard MMIC such as the MAR series, an INA-02170 costs more. MAR devices, which are limited to a 5 dB noise figure and relatively lower gain, cost less than $2 each. The INA-02170 costs $36.45 each in small quantities and $29.25 in quantities of 25. But I feel it's a bargain, considering the lower noise figure and high gain. Contact Avantek, 481 Cottonwood Dr., Milpitas, CA 95035 at (408) 432-3080 for the name of your nearest distributor.

### Solid State Amp

Vikki Welch questions the use of converters to stretch the base station into several bands. She was not satisfied with the lower power level of most converter systems. While not wanting to burn a hole in the sky, she wants a device with enough power to operate with.

Referring to the 6 meter solid state power amplifier in the September 1989 issue of *73 Magazine*, Vikki wants to know the values for the RF chokes used in the amplifier. Well, Vikki, I started the design from Motorola application notes that covered devices similar to an A50 (50 watt NPN power device at 50 MHz) transistor I had in my junk box. The values for the RFCs are as follows: The base RFC (RFC3) is about 10 turns of #22 wound on a large (0.35") ferrite bead (inductance about 10 µH). RFC1 (collector DC feed) was 10 turns of #22, air-wound, ½" in diameter, but I later replaced it with 10 turns wound on a 2 watt resistor, value not critical. RFC2, originally 18 turns on a T-50-6 ferrite core, was similarly replaced in the manner of RFC1.

The point is that the values are not critical, but you need a good RFC to ensure that it's doing its job—bypassing the RF. You can vary the bias circuits in almost any circuit constructed for class "C" operation (CW or FM), making them usable for SSB operation. See Figure 2 for a typical bias arrangement.

The bias circuit is tied into the lower end of the RFC (which is grounded for FM or CW operation), giving the transistor a bias voltage to turn the device on (slightly). The device will fully turn on with 0.7 volts on the base, going into hard conduction. What we want to do is control the base voltage to turn the transistor on just a little bit so the collector starts to draw a little current; say, about 50 to 100 mA. This makes the transistor stage operate in the linear portion of its curve. This requires a voltage in the range of 0.3 to 0.4 volts; any higher and the device will go into full conduction.

If you have a DC ammeter in the circuit, you should see a small increase in collector current without RF drive, applied as you adjust the bias on. The idea is to draw a small amount of collector current for SSB use, making the circuit linear. If your bias circuit is adjustable, set the collector current to about 50 mA for each device in your final amplifier. If the amplifier is to be used for FM, no bias is required for class "C" operation. For linear operation, the transistor is operated in a class "A" to "A/B" range.

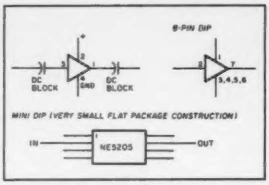

*Figure 3. NE-5205 Amplifier.*

### Adjusting New Amplifiers

When adjusting a new amplifier for the first time, it's best to begin with the input circuit match, and tune for best SWR. (DC collector power is not required at this time.) If it is on, use short adjust periods to avoid overheating. When you're finished, remove the drive, turn on the amplifier (DC power), and adjust the collector circuit through its full range. Watch the current meter for any increase in current indicating oscillations, and if there are any, re-position components to minimize any instability in the circuit.

Most amplifiers tend to be oscillators and most oscillators tend to be amplifiers. For most projects, you just have to do a little work to stabilize them. This procedure is not limited to the 6 meter power amplifier, but is typical of most amplifier alignment steps. Just be careful when working with expensive devices. Watch the dissipation ratings, and especially the polarity, as simple errors in judgment can ruin the device. With solid state devices you don't get a second chance; they can go up in an invisible smoke screen faster than you can say "X?•#!!!". Think the operation through first, then perform the step.

Michael Circ of Toronto is working with low frequency antennas for his Sony Pro-80 VLF receiver on 80 to 150 khz. He'd had trouble with a signetics wideband NE-5205 op amp. This 8-pin DIP op amp has a gain of 20 dB from DC to 600 MHz, with a 50 ohm impedance and noise figure of about 6 dB. The test circuit is almost identical to a standard MMIC amplifier's circuit. See Figure 3.

Michael questions the input match to a short telescoping antenna, and he's having trouble with the circuit. Michael, I have had similar troubles with some of the packaged amps, and I find that a high impedance FET gives a better match and a noise figure of less than 1 dB.

In tests, I found that the ferrite antenna N6IZW and I constructed was superior to a wire or telescopic antenna. You could use other material, such as a stripped antenna loop from an old FM tuner, to construct a similar, compact antenna, or buy a new ferrite rod from Amidon Associates, PO Box 956, Torrance CA 90508, phone (213) 763-5770.

You can add a short telescopic rod to the hot end of the ferrite antenna's coil. This would tend to make the antenna less directional than the ferrite rod by itself. See the February 1990 issue of *73* for details on the ferrite antenna.

A similar circuit, developed by David Curry WD4PLI, appeared in the June issue of *73*, page 30. He used a J-310 low-noise FET on the input circuit and a low-pass filter to reduce broadcast interference. His circuit uses a 5 to 10 foot wire antenna. Check out his article; it's quite a good construction project. He even has a kit available with all components for those interested. If you missed his article, write to *73 Magazine, Forest Road, Hancock NH 03449* for a copy.

Brian Grose KB7Y is looking for a source of 1N23 diodes. With the rise in popularity of 10 GHz operation, these sought-after detector diodes are getting hard to find. I remember when we were more interested in finding 1N4007s for our high voltage power supplies, and ignoring the 1N23 types. Now the 1N4007 is 10 cents and the 1N23 is $10. Quite a turn of events.

Why do some diodes cost so much? Coding of the devices starts with the plain vanilla or 1N23, which has a high noise figure of about 8 to 10 dB at 10 GHz. Next come the 1N23A, B,C,D,E and so forth. Each successive letter designation indicates a slightly lower noise figure. I believe the 1N23F, with about 5 dB at 10 GHz, is about the latest type available.

The 1N23WFR, a modification of the basic "F" diode, does not have a lower noise figure than the 1N23F. The "R" indicates that it's "reversed" from normal. See Figure 4. You can place the diode in a circuit of either polarity by removing the base sleeve and reversing it so that you can place it on the other end of the diode. Of course, low noise diodes with reversible polarity cost more than the plain old 1N23s. They all work well, but the lower the noise figure, the more sensitive your system will be.

Instead of running out and ordering devices, look in the junk boxes at swapmeets. The best place is in old microwave test sets and echo boxes once used for military radar applications. Some of them have one or more front panel devices, with spares in the lid of the set. Check it out. That junk radar test set could just be hiding

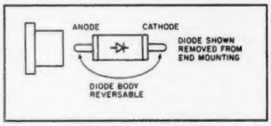

*Figure 4. Microwave diodes (1N21–1N23 types).*

lone or two or up to five 1N23 devices.

Additionally, several detector mounts or commercial military dual detector mounts are on the surplus market. They're usually turned down since the mounts are not for a frequency of interest. So what? If the price is right, just remove the diode and discard the piece of metal, if you don't need it. Usually you can obtain such items for bargain prices, around five dollars.

During the first thirty minutes of a large swapmeet, I have been known to be very antisocial, and even show up with a downward-looking stance, hat in place. I guess my brand of disease is parts-orientated, and must be satisfied by a hound dog hunting approach. While it is addictive, it usually subsides in twenty minutes to half an hour, and eventually returns you to back to normal. Hope you have good luck scrounging your local swapmeets. I might even bump into you at one, after the initial twenty minutes or so.

### New Microwave Product

Emcom Industries (Ed Emich) is introducing a 10 GHz wavemeter of very compact design from *The RSGB Handbook*, available for amateur use for about $100. The wavemeter is self-calibrating and capable of identifying frequencies to an accuracy better than 5 MHz at 10 GHz. It's simple to use, requiring only a coupling hole drilled into a section of waveguide for mounting. Unlike commercial wavemeters, which tend to be large and bulky, this six-inch-long wavemeter fits in your palm, making it adaptable for mountain topping and field frequency measurements.

The wavemeter is micrometer driven. Using your existing detector or external relative output meter as the reference indicator, you can adjust the wavemeter for a dip in power. When you see a dip output power on your external meter, note the micrometer reading and jot it down (quarter-wave reading). Then continue to adjust the micrometer in the same direction till another dip in the meter is observed (three-quarterwave reading). Now subtract the first reading from the second reading and divide the answer into 299,600 to obtain the operating frequency in MHz at 10 GHz. (Normally 300,000 is the correct number, but 299,600 is the correction for temperature and 32% humidity). The meter works from 9 to about 11 GHz. Contact Ed Emich at Emcom Industries, 10 Howard St., Buffalo NY 14206 or phone (716) 852–3711 for this and other items being developed for amateur microwave use.

Next month, we'll get back to the 6 GHz oscillator project. As always, I will be happy to answer any questions concerning VHF/UHF or microwave related items. Please send an SASE for a prompt reply, which you will receive except during 10 GHz contests and ARRL conventions. 73, Chuck WB6IGP.

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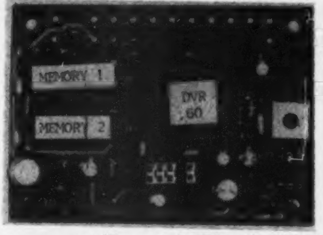

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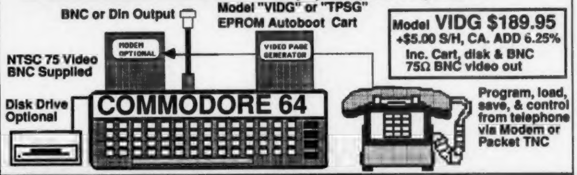

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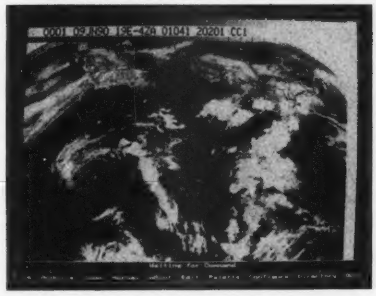

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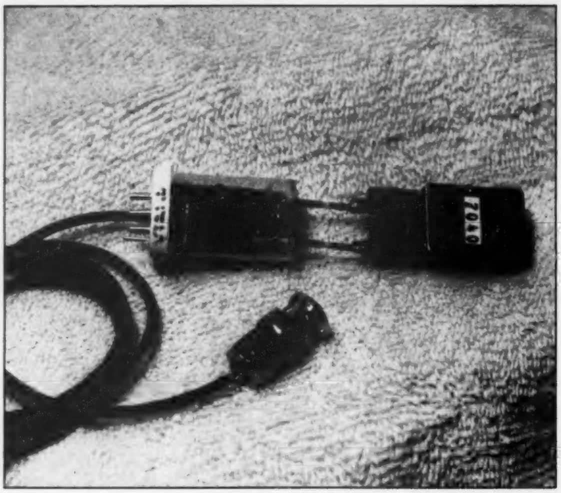


The entire DB25 rig.

*Mike Bryce WB8VGE*
*2225 Mayflower NW*
*Massillon OH 44646*

### The DB25 Rig

After several months of talking about VFOs and other means of controlling transmitter frequency, this month is a 180 degree turnaround. This month's project was the effort of Michael Czuhajewski WA8MCQ. Here's a short story on how this month's rig got its name.

"One day WB3EVS showed me a small plastic bottle which had previously contained DB-25 connector pins (for RS-232 computer use). A common bottle size is 3½ drams, with an inner diameter of 0.8 inches and a length of 1.4 inches. This is about 40% of the volume of a 35mm film canister, the size for the DB25 Challenge. Anything that would fit inside was defined as a DB25 rig, whether a receiver or transmitter.

"Initially I was confident of my goal to place a transmitter inside the container, but doubted that my partner could fit an entire transceiver inside. As things turned out, both our goals were achievable."

#### Specifications

WB3EVS and WA8MCQ loosely agreed on some rules: no surface mount devices; components and techniques had to be common and available; no one-transistor transmitters or crystal set receivers; transmitters must have at least an oscillator and amplifier, along with harmonic suppression on the output; crystal control, if used, could be external, but any VFO had to be inside the bottle; and finally, the rig must be capable of making actual contacts on the air. The output power was not specified, but they aimed for at least ¼W. A lot of things were not spelled out, to allow room for experimentation and innovation. They accepted this project as a challenge, rather than a competition.

#### Details of the Challenge

The rig is based on the "W1FB Tuna—Tin Two" from the May 1976 issue of *QST*. It puts out ½W on 40 meters. WA8MCQ used a piece of 0.8" x 1.4" perfboard with 0.1" hole spacing.

By comparison, WA5JAY built his rig on three perfboard discs, with the layers stacked on top of each other. QRP high-rise! His method was much more space-efficient. WA8MCQ quickly abandoned the idea of mounting the parts on both sides of the board. As a result, the only parts on the bottom are a resistor, a toroid, and a trimmer capacitor.

Wiring is all point-to-point, with several wires often sharing one hole. All external connections were made with wires coming out of the bottle. The participants in the DB25 Challenge suggest that at least one connector be included on the bottle, if possible.

WA8MCQ used a pair of 2N3904s for the crystal oscillator and amplifier. The plastic cases of the transistors were filed to obtain the same size heads and reduce bulk. WA8MCQ added another transistor to allow for a convenient method of keying the rig. "I cheated a bit," said WA8MCQ, "and used a 2SC2458 pulled out of a junked TS930S." You could also use a 2N3906.

Miniature parts such as 1/10 watt resistor, monolithic capacitors, and T25 and FT23 toroids, were used extensively. Both male and female DB-25 pins were used as connectors. These were tied onto the board with a single strand from stranded wire. The wires were then re-soldered for rigidity.

Matching pins are plugged into the wires for the crystal, power and key. The antenna connected via a piece of RG-174 coax terminated in a BNC plug. Two more pins were soldered onto a crystal socket, so it could be plugged into the bottle.

You can stick a jeweler's screwdriver through a hole in the side to tune the trimmer capacitor to pull the crystal frequency about 800 Hz. Power output ranges from 250 to 500 mW, depending on the frequency. The oscillator may be keyed or left on continuously while transmitting, depending on crystal activity. Jumper the appropriate pins on the board to select either mode. To key the oscillator along with the final, connect point "A" to point "B." To keep the oscillator running all the time, connect point "A" to point "C." The external T/R switch turns on the 12-volt transmit line.

WA8MCQ: "As any QRPer knows, ¼ watt is sufficient when coupled with a good antenna, propagation, and operator skill. I put the rig on the air over two weekends and made 10 easy contacts in seven states on 40 meters."

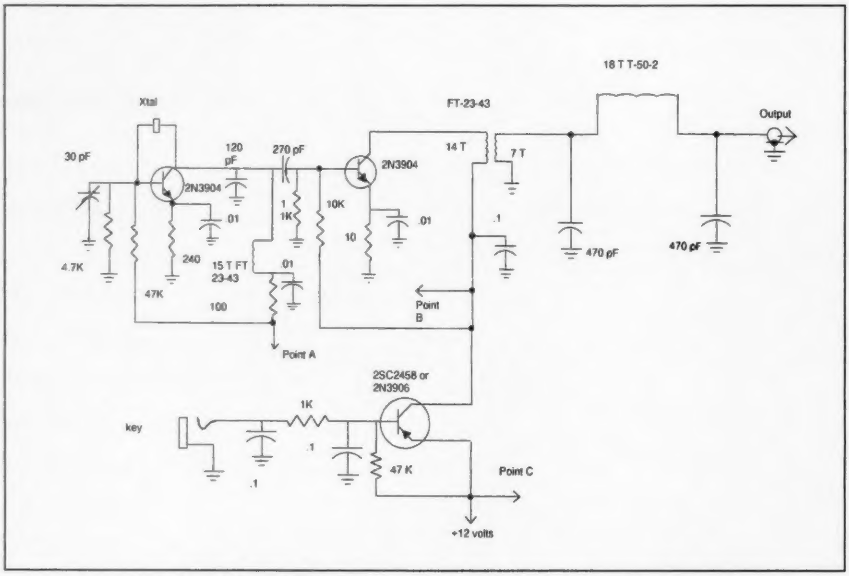
#### DB25 Contest

Are you up to the DB25 Challenge? Well, let me sweeten the pot. How about working 100 countries with the DB25? To do this, you'll need some guidelines to follow. These guidelines will be the same as those Mike WA8MCQ and Robbie WB3EVS adopted, with a few more I'll add myself:

If crystal controlled, a maximum of 10 crystals can be used. Since DB25 plastic bottles may be a bit hard to come by, you can use a 35mm film bottle. Fuji film comes in a clear plastic bottle. Maximum power output is 500 milliwatts. If VFO control is used, it must be internal. No net contacts or contacts made with higher power, and then switching to the DB25 will be allowed. The 100 countries must be on the active ARRL DX list. No contacts allowed before 1/1/91, to give everyone a fair start. Maximum time for completing the task will be two years.

Of course, you'll need the QSL cards, but photocopies will be fine. And a photograph of your rig.

So, what will you get out of all of this? How about a nice-sized trophy! One you'll be proud to show off to the rest of the world, and let them know just what 500 milliwatts can do. All from a rig you can put inside your shirt pocket.



*The schematic for the DB25 transmitter. Use 1/10 watt resistors and VERY small components.*

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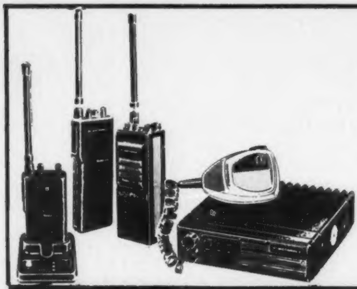

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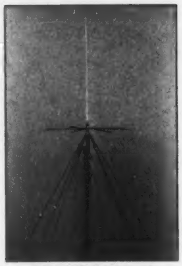

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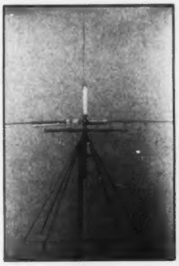

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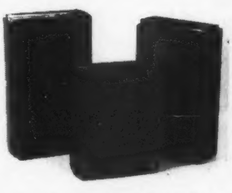

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# RANDOM OUTPUT

### David Cassidy N1GPH

Two or three young guys, sitting in a garage or basement. Along the wall is a table. On that table is an assortment of equipment, most of which would be quite familiar to the average ham (in fact, at least one of the young guys is probably a licensed amateur radio operator). The light from a single, dim bulb barely illuminates the equipment: an AM transmitter (something on the order of an old Heathkit, Johnson, or maybe even something the guys have been putting together themselves from scrounged parts), a cassette player, a D-104 microphone and assorted home-brew meters, switching boxes and processing gear. Notebook paper, all covered with a handwritten scrawl, is spread in disarray across the table. A stack of cassette tapes sits patiently before the player. The soft glow of the transmitter's finals escapes through the vent slots and adds a peaceful orange glow to the dim scene.

The transmitter is checked one last time. It is tuned precisely to 7.415, grid and plate are normal, the output is right around 50 watts and the SWR is rock steady at 1:1. A switch is thrown. The "transmit" light shines steadily. Someone hits "play" on the tape player and the microphone output is raised to mix with the down-home blues song coming from the cassette. The guys take a last hit off of their long-neck Budweisers, and one of them howls like a wolf into the silver disc of the D-104. This ain't no amateur radio... this is pirate radio!

**Radio Pirates**

Until recently, I hadn't really given much thought to this illegal fringe area of the radio hobby. With almost no exceptions, those who pursue this form of freedom of speech are careful to stay out of the amateur bands. It's difficult enough evading the long arm of FCC monitoring stations without having thousands of hams looking for you. I had never gone looking, nor had I ever stumbled upon, a pirate radio broadcast. Then, I picked up a copy of Andrew Yoder's excellent book, *Pirate Radio Stations: Tuning Into Underground Broadcasts* (available for $12.50 from Uncle Wayne's Bookshelf). Yoder's well-written book gives a complete overview, both historical and current, of the world of pirate radio stations. With his advice fresh in my mind, I started listening for these radio outlaws. This past Labor Day weekend, I was successful in monitoring one.

The station identified itself as W-O-R-K, "Workers Operating Radio Knobs." Their programming consisted of blues-oriented rock music and comedy skits. The signal quality was a bit on the weak side, further impaired by continuous static crashes, but I heard enough to verify the reception. I've written up a reception report, sent it to the mail drop address given during the broadcast, and I'm patiently waiting for the all-important QSL card.

If this mysterious branch of SWLing is something you want to check out, I can offer a few suggestions I've picked up. Pirate broadcasters confine their activities to a few narrow segments of the radio spectrum. Your best bet is to listen around 7.415 MHz, from 0200 to 0600 UTC, on a major holiday weekend like Labor Day, Memorial Day, July 4th, or Thanksgiving. In fact, one of the biggest times of the year for pirate radio activity is right around the corner—Halloween. If you listen to 7.415 on Halloween night, and you live in the eastern half of North America, you can almost guarantee that you'll hear something. April Fool's Day, and any time a Friday the 13th rolls around, are also good times. Other frequencies worthy of some monitoring are 1610–1630 kHz, 6200–6325 kHz, 6800–7000 kHz, 7355–7530 kHz and 15010–15100 kHz.

I would suggest that you pick up a copy of Yoder's book. It is a great overview of the entire topic. Another good resource is *The Pirate Radio Directory* by George Zeller ($7.95 at Uncle Wayne's Bookshelf). It gives information on over one hundred pirate stations including when and where they were last heard, programming notes and QSL information. For really up-to-date information, get in touch with The Association of Clandestine Radio Enthusiasts. They publish a monthly bulletin *(The ACE)* devoted to the topic. Sample copies are available for $2 from *The ACE*, P.O. Box 11201, Shawnee Mission KS 66201. You might want to check out the ANARC SWL net on 7240 kHz every Sunday morning at 10:00 EST. They discuss various topics of interest to SWLers, and they often have valuable information of interest to pirate chasers. Pirate station operators have even been known to inform the net of future broadcast plans.

**What Do You Think?**

The reason why I brought this whole thing up was to get your opinions. Some of you may think this topic too controversial for an amateur radio magazine. Others may feel that any topic concerning the transmission of a radio signal is fair game. Still others might be totally ambivalent. Either way, I'd like to hear what you have to say about it. Do any of you actively SWL these stations? Photocopy some QSLs and send them in. Have any of you operated such a station? Are any of you currently involved in pirate broadcasting? (You can write anonymously if you wish, but I assure you that your identity and QTH will go with me to my grave.) Should amateur radio operators be concerned about these outlaws, or are they really brothers and sisters following a different path to the same end?

Don't dismiss them out of hand, folks. These people are mostly highly skilled technicians who are very serious about their stations and the issue of free speech. They believe in freedom of the airwaves to the extreme that they're willing to risk heavy fines and jail terms to make their point about who should have the right and opportunity to broadcast a radio signal. I'm not necessarily defending their illegal broadcasts, but I think it would be a mistake brought on by simplistic thinking to say they should all be heavily fined and thrown into jail until they came around to the "proper" way of thinking.

Let me hear from you. If there's enough interest, maybe we'll publish some articles on the subject. If not, well... I know where I'll be this Halloween at 0200 UTC.

---

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# PROPAGATION

### Jim Gray W1XU

*Jim Gray W1XU*
*210 Chateau Circle*
*Payson AZ 85541*

**Ready for Good HF?**

This month is expected to be very good for HF radio propagation, with very few disturbances. It's possible that the first few days of the month will exhibit high magnetic field indexes (see the "A" index) with accompanying poor conditions on the 20–10 meter bands, but by the 4th or 5th, you ought to have plenty of DX coming through.

Again around the 14th and the 25th or 26th, you may find some magnetic field disturbances, but in general you will enjoy November's offerings for short and long skip. Bands will close sooner because darkness arrives early, but this is an advantage for those who enjoy DX on 160, 80, 40, and 30 meters. Reduced atmospheric noise will make conditions even better, with low QRN.

**Cycle 22**

The jury is still out regarding where Solar Cycle 22 is heading. At the time of writing this (late July), the sunspot numbers have remained steady and on a "plateau," with little change for about six months! Various forecasts have been made about the peak of Cycle 22. Some say it was in late 1989; others say early 1990; and still others say it will be in August of 1990. Perhaps they are all wrong, and there will be no peak as such, other than the plateau of fairly high values that don't approach the peak of earlier cycles.

It's too early to tell what Cycle 22 is going to do, but one thing is certain: It is like no other cycle in the several hundred years of sunspot observation! That period of time isn't even a wink in Old Sol's eye when we're dealing with a scale of *several billion* years... so anything could happen that has never been seen before! Be prepared for unusual solar activity in the next several years.

As always, listen to WWV (5, 10, 15, 20 MHz) at 18 minutes after any hour to find a current "A" index, "B" index, and solar flux values. Trends will be indicated by the announcement covering the last 24 hours and the next 24 hours.

Compare the MUF data on the band-time-area chart for an overall picture of when and where to find DX, and then use the daily chart to discover what "conditions" are likely to be on the days you want to work DX. P = Poor; F = Fair; G = Good. Example: P–F means Poor tending to Fair.

**EASTERN UNITED STATES TO:**

| GMT: | 00 | 02 | 04 | 06 | 08 | 10 | 12 | 14 | 16 | 18 | 20 | 22 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ALASKA | 10 | — | 20 | — | — | — | 20 | 20 | — | — | 15 | 10/15 |
| ARGENTINA | 15 | 15/20 | 20 | 40 | 40 | — | — | 10 | — | — | 10/15 | 10/15 |
| AUSTRALIA | 10/15 | 20 | 20 | 20 | 20 | 40 | 20/40 | 20 | — | — | — | 10/15 |
| CANAL ZONE | 15 | 20/40 | 20/40 | 20/40 | 20/40 | 15 | 15 | 10 | 10 | 10 | 20 | 10 |
| ENGLAND | 20 | 40 | 40/80 | 40/80 | 40 | — | — | 15 | 10 | 15 | 15 | 20 |
| HAWAII | 10/15 | 15 | 20 | 20 | 20/40 | 20/40 | 20 | 20 | — | — | — | 10/15 |
| INDIA | 20 | 20 | — | — | — | — | — | 15 | — | — | — | — |
| JAPAN | 10 | — | 20 | — | — | — | 20 | 20 | — | — | 15 | 10/15 |
| MEXICO | 15 | 20/40 | 20/40 | 20/40 | 20/40 | 15 | 15 | 10 | 10 | 10 | 20 | 10 |
| PHILIPPINES | 15 | — | 20 | 20 | — | — | 20 | 10/15 | 10 | — | — | 15 |
| PUERTO RICO | 15 | 20/40 | 20/40 | 20/40 | 20/40 | 15 | 15 | 10 | 10 | 10 | 20 | 10 |
| SOUTH AFRICA | 20/40 | 40 | 20 | 20 | — | — | — | — | 10 | 10 | 15 | 15 |
| U.S.S.R. | 40 | 40/80 | 20 | 20 | — | — | — | 10/15 | 10/15 | — | 20 | 20 |
| WEST COAST | 20/40 | 20/40 | 20/40 | 40 | 40 | — | — | 10/15 | 10/15 | 10/15 | 10/15 | 20 |

**CENTRAL UNITED STATES TO:**

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ALASKA | 10/15 | 15 | 20 | 20 | 20 | — | 20 | 20 | — | — | — | 10/15 |
| ARGENTINA | 15 | 15 | 20/40 | 20/40 | 20 | — | — | 10 | — | — | 10 | 10/15 |
| AUSTRALIA | 10/15 | 15 | 15 | — | 20 | 20/40 | 40 | 20 | — | — | 15 | 10 |
| CANAL ZONE | 15/20 | 15/20 | 20/40 | 20/40 | 20/40 | — | — | 10/20 | 10/20 | 10 | 10 | 10 |
| ENGLAND | 40 | 40/80 | 40 | — | — | — | — | — | 15 | 15 | 20 | 20 |
| HAWAII | 15 | 15 | 15 | 20 | 20 | 20/40 | 40 | 20 | — | 10 | 10 | 10 |
| INDIA | 15 | 15/20 | — | — | — | — | — | 15/20 | 15 | — | — | — |
| JAPAN | 10/15 | 15 | 20 | 20 | 20 | — | 20 | 20 | — | — | — | 10/15 |
| MEXICO | 15/20 | 15/20 | 20/40 | 20/40 | 20/40 | — | — | 10/20 | 10/20 | 10 | 10 | 10 |
| PHILIPPINES | 10/15 | — | 20 | 20 | — | — | — | — | 10/15 | 10/15 | — | — |
| PUERTO RICO | 15/20 | 15/20 | 20/40 | 20/40 | 20/40 | — | — | 10/20 | 10/20 | 10 | 10 | 10 |
| SOUTH AFRICA | — | — | 20 | 20 | — | — | — | — | 15 | 15 | 15/20 | 20 |
| U.S.S.R. | — | — | — | — | — | — | — | 15 | 15 | 15 | 20 | 20 |

**WESTERN UNITED STATES TO:**

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ALASKA | 10/15 | 10/15 | 15 | 20 | 20 | 20 | — | 20 | 20 | — | — | 15 |
| ARGENTINA | 10/15 | 15 | 15 | 20 | 20 | — | — | — | — | — | 10 | 10 |
| AUSTRALIA | 10 | 10/15 | 15 | 15 | 20 | 20 | 20 | — | 20 | — | — | — |
| CANAL ZONE | 10 | 15 | 15/40 | 20/40 | 20/40 | — | — | — | 10 | 10 | 10 | 10 |
| ENGLAND | 20 | 20 | — | — | — | — | — | — | 15 | 15 | 15/20 | 20 |
| HAWAII | 10/15 | 10/15 | 15 | 15/20 | 20/40 | 20/40 | 40 | — | 15 | 10 | — | — |
| INDIA | — | 15 | 20 | — | — | — | — | — | 15/20 | 15 | — | — |
| JAPAN | 10/15 | 10/15 | 15 | 20 | 20 | 20 | — | — | 20 | — | — | 15 |
| MEXICO | 10 | 15 | 15/40 | 20/40 | 20/40 | — | — | — | 10 | 10 | 10 | 10 |
| PHILIPPINES | 10 | 10 | — | — | — | — | — | 20 | 15 | 15/20 | — | — |
| PUERTO RICO | 10 | 15 | 15/40 | 20/40 | 20/40 | — | — | — | 10 | 10 | 10 | 10 |
| SOUTH AFRICA | 20 | 20 | — | 20 | — | — | — | — | — | 10 | 15 | 15 |
| U.S.S.R. | 20 | — | — | — | 20 | — | — | 20 | 20 | 20 | 20 | 20 |
| EAST COAST | 20/40 | 20/40 | 20/40 | 40 | 40 | — | — | 10/15 | 10/15 | 10/15 | 10/15 | 20 |

*Notes: 1. The numbers usually indicate the highest usable frequency band. Where two bands are listed (20/40, for example), both could well work on that path at that time. 2. Always look at the next highest band as well for any listing. 3. For WARC bands, use 10 for 12, 15 for 17, and 40 for 30 meters.*

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| SUN | MON | TUE | WED | THU | FRI | SAT |
|---|---|---|---|---|---|---|
| | | | | 1 P | 2 P | 3 P–F |
| 4 F | 5 F–G | 6 G | 7 G | 8 G | 9 G | 10 G–F |
| 11 F | 12 F–P | 13 P | 14 P | 15 P–F | 16 F–G | 17 G |
| 18 G | 19 G | 20 G | 21 G–F | 22 F | 23 F | 24 F–G |
| 25 G–F | 26 F–P | 27 P | 28 P–F | 29 F | 30 G | |

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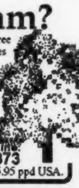

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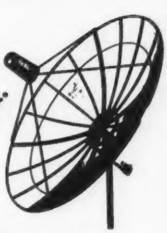

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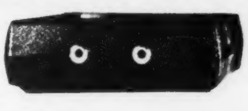

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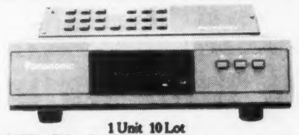

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*Arnie Johnson N1BAC*
*103 Old Homestead Hwy.*
*N. Swanzey, NH 03431*

### Notes from FN42

*November has arrived. For the citizens of the United States it means national voting and of course a very American holiday called Thanksgiving. It is a time of giving thanks for what we have, as the Pilgrims who landed at Plymouth Rock did so many years ago.*

*What do we in the international ham community have to give thanks for? I think the primary thing is the lowering or destruction of barriers to communication. We are now able to communicate face-to-face, not just by radio, with hams in all of Germany; we are able to send QSL cards directly to hams in the USSR, not just Box 88, Moscow. More countries, like Israel, are lifting communications restrictions with other countries, and more areas are becoming available to DXpeditions. We can be thankful for all the frequencies we have available, and for the many people who worked hard at WARC-79 to get these frequencies for us.*

*The next World Administrative Radio Conference (WARC) will be held starting February 3, 1992, less than 16 months from now. How is this going to affect us? I honestly don't know, but I do know that commercial interests want more frequencies, whether HF, VHF, UHF, or even higher.*

*We are more communication-oriented than ever before. How many of you have a commercial radio or cellular telephone in your car that you didn't have back in 1979? Will the cellular phone industry need more frequencies? Probably so, and where will they get them? From our ham bands? HF broadcasting also wishes to increase its frequency spectrum in the 40 meter band.*

*I am happy to say that there is an international organization, the International Amateur Radio Union, that attempts to preserve our frequencies. It's composed of many national organizations, such as the United States Amateur Radio Relay League (ARRL), the Japan Amateur Radio League (JARL), and many others. The IARU and national ham organizations will be working hard to conserve what we now have, and even attempt to gain new frequencies for us. What can we do to help?*

*We can provide support for these efforts! What kind of support? I can't provide technical support because I am not that technically able, and I can't provide physical support because I can't take the time off from my job to go. But I can contribute financially to help pay for those who do attend. I urge all hams, worldwide, to do the same. Support your national organization with a donation, no matter how small. What happens in 1992 will determine what frequency privileges we will enjoy thereafter. Don't be a couch potato; get involved!—Arnie, N1BAC*

### Roundup

**Japan** From *The JARL News.* Last spring the JARL and the RSF (USSR) reached an agreement to allow the JARL to participate in the International ARDF Competition that was held from June 2 to 8, 1990 in Krasnodar, USSR.

The Japanese team, led by Mokoto Inami, Vice President of the JARL, consisted of 14 members. Everyone participated in the competition side-by-side with other nationals, and the spirit of cooperation and lasting friendship formed easily.

On that occasion, the JARL and RSF agreed to exchange ARDF teams, with the JARL inviting the RSF team to the National Foxteering Competition this October in the Hyogo area.

As a result, the friendship between the JARL and RSF will most certainly be deepened.

*Special event station 8J6JEN* will operate until November 4, 1990, from "The Journey Exposition, Nagasaki 1990." Operation began last August 3. The Exposition hopes to rediscover Nagasaki's rich history of international exchange and to serve as a place for people to meet and exchange views and enhance human communication.

**The Netherlands** From *Radio Netherlands*, Programme Information Release, fall. Two years ago we published the last edition of the "Receiver Shopping List," a free consumer guide to the receiver market. At the start of 1989 we stopped sending it out because the information was no longer current. BUT, the new 12th edition of the "Receiver Shopping List" is now back from the printers.

The new list includes price checks made in Holland, Canada, Britain, the US, Japan, South Africa, New Zealand, and Australia. If you would like a copy just write to: English Section, Radio Netherlands, Box 222, 1200 JG Hilversum, The Netherlands; or FAX +31 35 724352. Ask for the "Receiver Shopping List," Edition 12. *[The list is 56 half pages long, lists 31 receivers, and contains other useful information, such as a section on finding parts for older sets. It's well done, and it's FREE.—Arnie]*

**ISRAEL**

*Ron Gang 4X1MK*
*Kibbutz Urim*
*Negev MPO 85530*
*Israel*
*Packet: 4X1MK@4Z4SV*

**Ham Radio and the "Situation."** At the time of this writing (late August), storm clouds are gathering in our region, and the situation is full of uncertainties making us all a little shaky, to say the least. In past reports, I've pointed to all kinds of events in our world of amateur radio connected to larger events on the globe, showing that international harmony has been growing and pointing to what appears to be a dawning of a new, enlightened age for our planet. By the time these words are in print, the events at this time may have resolved themselves, and all one can do at this time is to express the hope for the continued betterment of our world.

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SPECIAL EVENT OPERATION
US1A
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*Photo A. Sticker from the world's first joint Soviet-U.S. special event station, US1A.*

A few months back we reported that our Ministry of Communications had lifted a ban on communications with the surrounding Arab countries with whom peace has not yet been concluded. A few QSOs have been made, and at an international forum early in the summer, a representative of the Israel Amateur Radio Club personally received some favourable comments from a delegate of one of these Arab lands. The ice has definitely been broken, yet as we have seen in the past in terms of international relations, it takes some time for the politics to follow suit.

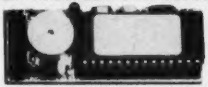
Now a local radio station in Israel has been broadcasting some recordings from the station of 4X4WH of QSOs with stations in Iraqi-occupied Kuwait giving commentary on the situation there. Thus in the time of crises, once again amateur radio comes through providing a unique service!

**Privileges Granted to Novices.** The Ministry of Communications, on their own initiative (!), has granted Grade C licensees the use of all modes on the 144–146 MHz band with maximum power output of 25 watts. This will make the national repeater and packet systems available to the holders of this entry-level license requiring a 6 words per minute Morse and a simple theory and operating procedures tests. This puts the Novices into the mainstream of Israeli ham radio. The Novices have been allowed 15 watts output on CW between 7.000 to 7.050 and 21.100 to 21.150 MHz, and two years ago they were granted all modes at 430 to 440 MHz. Not very many appeared on UHF in spite of the perk of being able to use voice, and now in the spirit of generosity, the authorities have extended the privileges. Look for the Novice callsign: a 4Z9 prefix followed by 3 letters.

Now, a month and a half after the Novices received the 2 meter privileges, their presence is really being felt on the band! In the previous year I had worked only a handful on 70 cm., but now on VHF they are really coming out in multitudes! At this early stage in the game, we hear them mingling with the veteran hams, getting all kinds of advice on technical and operating matters. One Novice callsign has been seen already on the national packet system.

This changes the very nature of the Novice experience and makes the Grade C license much more attractive! It will be interesting to note how this will affect licensing patterns. Will the Novice licensees continue to upgrade as in the past when there was a greater incentive to do so? Even though, as opposed to many countries, ham radio attracted a great influx of youngsters in Israel in spite of the rather strict licensing conditions, will there be an even greater influx of new blood into the hobby? I'll be feeling the pulse, and in a future issue will keep you informed of the trends, which could have implications for amateur radio in your country.

**Israel soon to join the European Common License Group.** By the time you're reading this, we hope the Ministry of Communications will have signed all the agreements to facilitate



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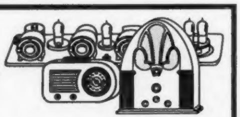

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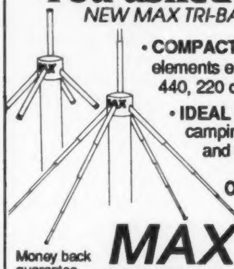

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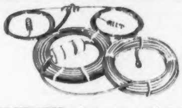

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our entry into the European Common License Group. This will make it possible for all hams from the CEPT countries visiting Israel to get on the air here without the minor bureaucratic hassle of getting a reciprocal license. It will allow 4X/4Z hams the same while touring the 16 CEPT countries. *[Very exciting news!—Arnie]*

In the meantime, any ham planning a visit to Israel may obtain details on how to get a reciprocal license as well as a list of the Israeli VHF and UHF repeaters by writing to me. Be sure to include a self-addressed envelope and return postage.

**Hulah Valley Packeteers host TAPR head.** On July 11, Lyle Johnson WA7JXD, President of the Tucson Amateur Packet Radio Corporation, was the speaker at a meeting of the Hulah Valley Packet Group held at the community center in the village of Rosh Pina. Lyle outlined the progress on the production of the TAPR high-speed packet transceiver and reported on the state of the Microsats, the flock of amateur radio satellites launched this year, many of which are carrying packet radio gear.

**4X90BS.** From October 5–6, the capital city of the Hegev, Beer Sheva, hosted an international stamp exhibition. The special station 4X90Beer-Sheva was set up there and operated on all bands around the clock. Not only did it give prefix hunters around the world a new one, but we hope, as in similar events, many philatelists will be infected by the ham virus!

**REPUBLIC OF KOREA**

*Byong-joo Cho HL5AP*
*PO Box 4, Haeundae*
*Pusan, 612-600*
*Korea (South)*

**Reciprocal Agreement.** I am very pleased to provide the following information concerning a reciprocal agreement for US citizens to operate an amateur station in Korea.

The Korean Ministry of Communication has requested that a reciprocal licensing operation agreement between Korea and the USA be developed. The MOC has asked the Korea Ministry of Foreign Affairs to request the agreement.

The Ministry of Foreign Affairs will note the conclusion of such an agreement on government information bulletins. The callsign prefix for reciprocal licensees is now under study. It is hoped that this agreement will be concluded by October 1990.

**Special callsign.** I shall be operating under a special callsign for myself, either 6K30AP or HL30AP, from September 1 to December 31, 1990 for commemoration of my amateur radio station's 30 years of operation and my 60 years of age. I will be operating on all WARC bands and modes, and will be issuing a special QSL card for this special callsign operation.

Korean nationals became able to get on the air in September 1960 with HM individual callsign, not a club callsign. I got my call HM1AP in December 1960 and received HM9AP as a mobile call in January 1963. Korea Amateur Radio League (KARL) Headquarters received HM9A. Now I am the oldest individual call holder in the Republic of Korea and a charter/life member of KARL.

**SPAIN**

*Woodson Gannaway N5KVB/EA*
*Apartado 11*
*35450 Santa Maria de Guia*
*(Las Palmas de G.C.)*
*Islas Canarias, Espana*

**Hello to all from the Canary Islands.** Some very nice news this month from the mainland and a few short "odds and ends."

I didn't make it to Rumania this year as I had hoped, but will attempt to put it back in my plans in the future. I am getting interested in experimenting again and that is likely to produce some QRP activity from my QTH. Lastly, the price for a temporary /EA license in Spain went down this year to 1000 pesetas (US$10). This license is still good for a calendar. And now to the mainland.

**Hello from mainland Spain.** I am NP4NQ/EA7. I am now at the Naval Base in Rota (Cadiz). I've been pretty active on 10 meters and 2 meter FM DX. That's all the equipment I have now.

We have at least 6 more hams on this base, with a few Spanish workers that are hams as well. It is kind of hard for the active-duty Navy personnel to dedicate all the time we would like on our hobby, but we still get on the air. On 2 meters FM I have talked to the Canary Islands, Morocco, Portugal, and a little DX in Spain. I find it fun since I don't have a SSB/VHF rig with me. There are a few contests *[contesters?]* on this mode around here, like ED7TDP in Cadiz.

We, the hams in Rota (both US and Spanish), would like to say that amateur radio is alive and well in the naval base of Rota. It is just like an extended DXpedition . . . so it seems sometimes! I've been at it for almost 4 years, and I'm certainly glad to have brought this equipment with me. Our main contacts on the base are EA7CZR and EA7PS, our so-to-speak hosts, and in some instances, QSL managers. This speeds up QSL cards in Europe. The hams in the town are also very, very cooperative.

I would also like to say "Hi" to all, from the hams here: NT8X/EA7, AA2AH/EA7, and myself NP4NQ/EA7. 73s and DX Amigo de Canarias! AT3 Jose A. Delgado (USN), Apartado 33, Box 10 (VQ-2), Base Naval de Rota, (Cadiz) Espana.

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# UPDATES

## Alinco DJ-500 Special

**Like all companies, Alinco sometimes has specials.** In the middle of last September, we received word that the Alinco DJ-500 dual-band handheld was sent to dealers as a promotional special with a 30-day warranty. An optional two-year warranty was available for a minimal charge (no more than $15). Except for this clearly marked special, the warranty information given in Gordon West's "Alinco Service Survey" in the September issue is correct.

## JAN Crystals—Phone Number

**From Bill Burdette of Burdette Marketing & Communications, Inc:** "On page 20 of the August issue, you published our telephone number instead of the number for JAN Crystals. While we are the advertising agency for JAN Crystals, we would appreciate it if you would advise your readers to contact JAN Crystals directly, at (800) 526–9825."

## JA8IJY G3 FAX Controller for Ham FAX

**From David Cowhig WA1LBP:** "Here are equivalents for the Japanese ICs used in the JA8IJY FAX modem for hams described on page 24 of the May 1990 issue. IC 2072D is the one-chip VOX IC NJM2072 from Shin Nihon Musen (JRC Devices). IC 78L05 is a three-terminal series regulator (rating 100 mA at 5 volts max) for a power supply made by many companies, such as TI and Motorola.

"I got this info from Japan through JUNET, a Japanese language e-mail conferencing network analogous to the USENET, accessible worldwide through many networks. Thanks to OHO Kazuhiko of the Packet Radio User's Group, CHIKARAISHI Hirotaka of the Tokyo Institute of Technology, and Jon Iza W1/EA2SN in Massachusetts for their advice.

"The author of the FAX modem interface, Mr. Fukunishi JA8IJY, welcomes questions. Send your letters with SASE to: Mr. Keizo Fukunishi, Migi 5, 14 Ichijodo, Asahikawa shi, Hokkaido pref., 070 JAPAN. Tel. Day: +81-166-24-2851. Night: +81-166-62-0526."

## GM is Scotland

**From Duncan Lindsay GM7CXM:** "Your August '90 edition of Ham Help lists GM4PLM's country as England. This ignorance is expected from most Americans, but surely all you DX chasers know that GM is Scotland?"

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73T05 **"Genesis"** **$5.95**
**5 wpm**—This is the beginning tape, taking you through the 26 letters, 10 numbers, and necessary punctuation, complete with practice every step of the way. The ease of learning gives confidence even to the faint of heart.

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**20+ wpm**—Congratulations! Okay, the challenge of code is what's gotten you this far, so don't quit now. Go for the extra class license. We send the code faster than 20 per. It's like wearing lead weights on your feet when you run: You'll wonder why the examiner is sending so slowly!

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# TECH KNOWLEDGY

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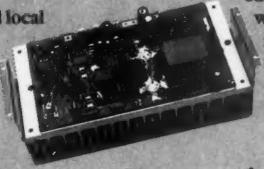
What is "tech knowledgy"? Read the facts.

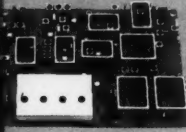
### 200 Watt Transmitter

The FT-1000 delivers continuously adjustable output from 20 to 200 watts. Using a massive power transformer and powerful 10" squirrel cage blower, the FT-1000 far outdistances linears requiring 100–150W output. The full 200 watts output and exceptional audio provide outstanding "barefoot" pile-up performance.

Clean DDS derived local signals and conservative design mean the FT-1000's MRF-422 final transistors, operating at a 30 volt Vcc level, offer third order IMD of −36 dB at 150W PEP. The FT-1000 may be used at 100 watts output continuous duty.



200 Watt Amp



DDS Circuitry

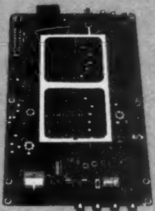
### Direct Digital Synthesis

Yaesu assembled a special independent R&D team to create the FT-1000's Direct Digital Synthesizers. Two 10-bit and three 8-bit DDS permit very low carrier/noise on transmitted signals and wide receiver blocking dynamic range by providing exceptionally clean VFO sources to the PLL local oscillators.

### Dynamic Range

Enjoy unparalleled strong signal handling with the FT-1000. You get 14 five-pole main receiver front end bandpass filters (11 on the optional BPF-1), a switchable cascode dual JFET RF preamp, and a double-balanced mixer ring using high-Idss JFETs.

In addition, the front end gain distribution may be adjusted by switching to IPO, or by adding attenuation in 6 dB (1 S-Unit) steps. Typical measured two-tone dynamic range is 108 dB (at 50 kHz, 500 Hz BW, preamp off), yielding a +32 dBm 3rd order IP1.



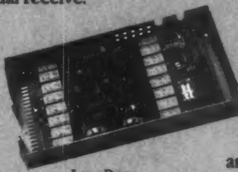
Receiver Circuitry

Dual Tuning

### Simultaneous Dual (Unlimited) Frequency Reception

On the FT-1000, each receiver (Main and Sub) has its own weighted flywheel tuning knob and the two receive channels may be different modes and/or different filter bandwidths. Add the optional BPF-1 module for crossband dual receive.

Use headphones or speakers for monitoring, mixing or splitting audio in either mono or stereo. A single RX MIX control adjusts the relative volume of each channel. Install the optional BPF-1 and enjoy true diversity reception by using a separate antenna for each receive channel.



Low Pass Filter

### Competition-Grade Receiver

Frequency, mode and bandwidth information are stored independently for each of the two vfos on each band (or the 100 memories). Filter bandwidths of 2.4 kHz, 2.0 kHz, 500 Hz and 250 Hz along with an IF notch filter, IF Shift, variable bandwidth and a CW Audio Peaking Filter provide unmatched ORM rejection. Plus, the FT-1000 offers a dual-mode noise blanker and all-mode squelch. The front-panel RX ANT switch allows convenient enabling of your Beverage or loop receiving antenna.

The optional DVS-2 Digital Voice Storage unit gives you a 16-second receive memory to correct potential "busted calls" or dump an important OSO to tape for archival purposes. The DVS-2 also functions a two- or four-memory voice "CQ Machine" for contests.

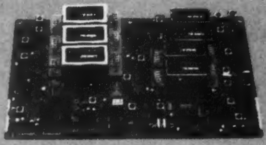
### CW Operation

The FT-1000 provides the most complete package ever offered to demanding CW operators. For instance, CW Spot, samples your (offset) CW carrier, assures precise "zeroing" during pileups. Other exceptional features include BFO offsets of 400, 500, 600 or 700 Hz, a PLL-controlled CW tuning visual indicator, built-in electronic keyer and full QSK. Key jacks for paddle input are located on *both* front and rear panels.

### Optimal Digital Communication

The FT-1000 offers special provisions for RTTY/AMTOR and packet modes including an independent, built-in microprocessor to control AFSK generation. Use the RTTY mode button to select Mark frequencies and Hz shifts. The display can show the Mark or any offset you load in.

Non-standard tone pair/shifts can also be accommodated with the manual IF shift and independent display offset adjustment on the front panel.



IF Filter

### Flexible Mode and Filter Selection

Each receiver (main and sub) has its own vfo on each of 10 bands and each of these vfos has two sub-band channels. As a result, the FT-1000 give you 40 tunable vfo channels and 99 tunable memories—each with its own independently selected and memorized filter and mode combination.

**Tap into the FT-1000 Tech Knowledgy**
Call your local Yaesu dealer today!

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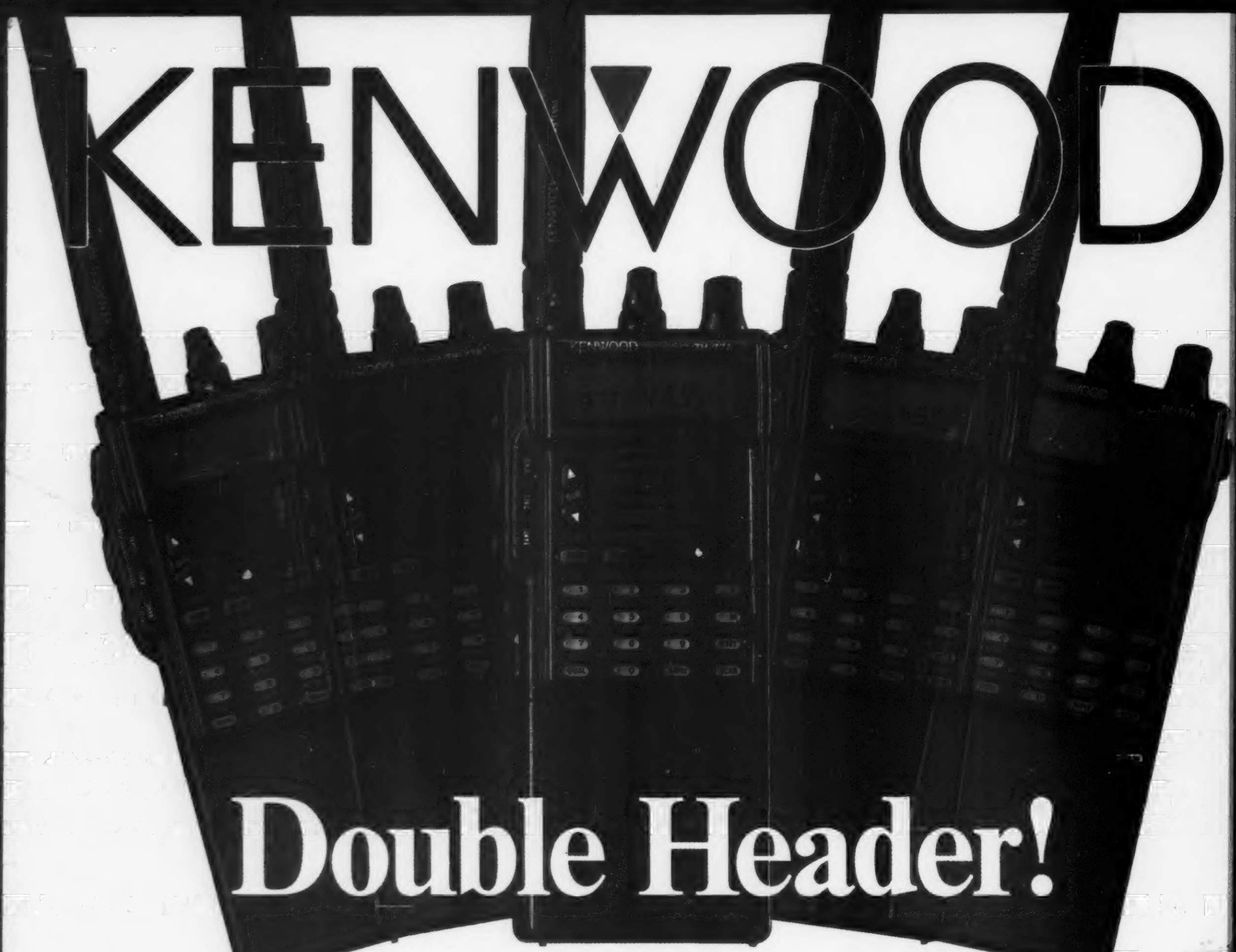

## TH-77A

### Compact 2m/70cm Dual Band HT

**Here's a radio that deserves a double-take! The TH-77A is a feature-packed dual band radio compressed into an HT package. The accessories are compatible with our TH-75, TH-25, and TH-26 Series radios. Repeater and remote base users will appreciate the DTMF memory that can store *all* of the DTMF characters (*, #, A, B, C, and D) that are usually required for repeater functions!**

- **Wide band receiver coverage.** 136–165 (118–165 [AM mode 118–136] MHz after modification) and 438–449.995 MHz. TX on Amateur bands only. (Two meter section is modifiable for MARS/CAP. Permits required.)
- **Dual receive/dual LCD display.** Separate volume and squelch controls for each band. Audio output can be mixed or separated by using an external speaker.
- **Cross band repeat function.**
- **Dual Tone Squelch System (DTSS).** Uses standard DTMF to open squelch.
- **CTCSS encode/decode built-in.**
- **Forty-two memory channels.** All channels odd split capable.
- **DTMF memory/autodialer.** Ten 15-digit codes can be stored.
- **Direct keyboard frequency entry.** The rotary dial can also be used to select memory, frequency, frequency step, CTCSS, and scan direction.
- **Multi-function, dual scanning.** Time or carrier operated channel or band scanning.
- **Frequency step selectable for quick QSY.** Choose from 5, 10, 12.5, 15, 20, or 25 kHz steps.
- **Two watts (1.5 W on UHF) with supplied battery pack.** Five watts output with PB-8 battery pack or 13.8 volts. Low power is 500 mW.
- **DC direct-in operation** from 6.3–16 VDC with the PG-2W.
- **T-Alert with elapsed time indicator.**
- **Automatic repeater offset on 2 m.**
- **Battery-saving features.** Auto battery saver, auto power off function, and economy power mode.
- **Supplied accessories:** Flex antenna, PB-6 battery pack (7.2 V, 600 mAH), wall charger, belt hook, wrist strap, keyboard cover.

**Optional accessories:**
• **BC-10:** Compact charger • **BC-11:** Rapid charger • **BH-6:** Swivel mount • **BT-6:** AAA battery case • **DC-1/PG-2V:** DC adapter • **DC-4:** Mobile charger for PB-10 • **DC-5:** Mobile charger for PB-6, 7, 9 • **PB-5:** 7.2 V, 200 mAh NiCd pack for 2.5 W output • **PB-6:** 7.2 V, 600 mAh NiCd pack • **PB-7:** 7.2 V, 1100 mAh NiCd pack • **PB-8:** 12 V, 600 mAh NiCd for 5 W output • **PB-9:** 7.2 V, 600 mAh NiCd with built-in charger • **PB-11:** 12 V, 600 mAh OR 6 V, 1200 mAh, for 5 W OR 2 W • **HMC-2:** Headset with VOX and PTT • **PG-2W:** DC cable w/fuse • **PG-3F:** DC cable with filter and cigarette lighter plug • **SC-28, 29:** Soft case • **SMC-30/31:** Speaker mics. • **SMC-33:** Speaker mic. w/remote control • **WR-1:** Water resistant bag.

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